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MYCOTAXON

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TAXONOMY & NOMENCLATURE OF FUNGI, INCLUDING LICHENS

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MYCOTAXON

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TAXONOMICAL STUDIES ON USTILAGINALES. XXIII.

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Key words: smut fungi, Ustilaginomycetes, new species, new combinations, synonyms, excluded species, lectotypifications.

ABSTRACT

Fifteen NEW SPECIES of smut fungi are proposed: *Entyloma frondosa*, *Macalpinomyces elionuri-tripsacoidis*, *M. ugandensis*, *Restiosporium dapsilanthi*, *Sporisorium absconditum*, *S. berndtii*, *S. compactum*, *S. cymbicum*, *S. divisum*, *S. eriochrysis*, *S. rhytachnes-rottboellioidis*, *S. sphacelatum*, *S. tothii*, *S. tristachyae-nodiglumis* and *S. zambianum*. NEW NAME proposed: *Sporisorium spegazzinii*. NEW COMBINATIONS are: *Macalpinomyces elymandrae*, *M. pretoriensis*, *Moreaua apicis*, *Sporisorium anadelphiae*, *S. argentinum*, *S. barberi*, *S. bengalense*, *S. cymbopogonis*, *S. densiflorum*, *S. lanigeri*, *S. mildbraedii*, *S. mutabile*, *S. nardi*, *S. panici-carthaginense*, *S. parodii*, *S. pennisetinum*, *S. spermoideum*, *S. urelytri*, *Tranzscheliella halophila*, *T. halophiloides*, *T. jacksonii*, *T. macrochloae*, *T. minima*, *T. sparti* and *T. ventanensis*. EXCLUDED SPECIES are: *Entyloma ameghinoi*, *E. nectrioide* and *Ustilago lycoperdospora*. LECTOTYPES are designated for *Entyloma chilense*, *Tilletia eremophila* and *Ustilago paraguayensis*. Revision of different groups of smut fungi resulted in the establishment of twenty TAXONOMIC SYNONYMS. KEYS to eleven groups of smut fungi are compiled.

THE GENUS *TRANZSCHELIELLA* (USTILAGINACEAE)

Lavrov (1936:29) proposed the genus *Tranzscheliella* on the basis of two, small, supposed "cells" attached at opposite sides of the spores of *T. otophora*. What Lavrov considered to be cells are actually the oppositely situated opercula (circularly broken parts of the thick exospore, standing off from the spore). This character alone is perhaps insufficient for recognising a separate genus. However, *T. otophora*, together with the closely related *Ustilago hypodytes* complex, differs markedly in several aspects from *Ustilago hordei*, the type of the genus *Ustilago*. Therefore, I am proposing to widen the circumscription of *Tranzscheliella*, including in it several related species.

Tranzscheliella Lavrov, emend. Vánky

Sori superficial, naked, surrounding the distal internodes or the aborted inflorescence branches of Gramineae, which are covered by powdery spore masses. Infection systemic. Spores solitary, pigmented (brown), operculate or not, small (usually less than 8 µm long). Spore germination results in phragmobasidia. Host-parasite interaction by intracellular hyphae lacking interaction apparatus. Mature septa are poreless.

Currently, *Tranzscheliella* has three species: ***T. comburens*** (F. Ludw.) Vánky & McKenzie, type on *Danthonia* sp., ***T. hypodytes*** (Schltdl.) Vánky & McKenzie, type on *Elymus arenarius* L., and the type of the genus, ***T. williamsii*** (Griffiths) Dingley & Versluys, type on *Stipa richardsonii* Link (for synonyms, description and illustration see Vánky, 2002b:162-163). There are further *Ustilago* species which are better to be placed into this genus.

Tranzscheliella halophila (Speg.) Vánky, **comb. nov.**

Basionym: *Ustilago halophila* Spegazzini, Anales Mus. Nac. Buenos Aires, Ser. 3, 1:58, 1902. — Type on *Distichlis scoparia* (Kunth) Arechav., Argentina, Santa Fé, near Rufino, XII.1900, C. Spegazzini, LPS 3198. Isotype HUV 13520!

Ustilago stipae-barbatae Maire, 1917:139. — *Cintractia stipae-barbatae* (Maire) Maire, in Maire & Werner, 1937:44. — Lectotype (design. by Vánky, 1985:256) on *Stipa barbata* Desf., Morocco, Taourirt, 4.VI.1916, L. Ducellier, MPU, Herb. Maire 4226! Syntype on *Stipa gigantea* Link, Algeria, Miliana, near the top of Zaccar Rharbi, 12.VII.1917, R. Maire, MPU, Herb. Maire 4810! (syn. by Vánky, 1988:372). For description and ill. see Vánky, 1994:359 & 404.

On Gramineae: *Distichlis scoparia* (Kunth) Arechav., *D. spicata* (L.) Greene, (*D. maritima* Raf.), *D. stricta* (Torr.) Rydb., *Stipa barbata* Desf., *S. gigantea* Link (*Macrochloa arenaria* (Brot.) Kunth), *S. pennata* L.; Africa, Asia, N. & S. America.

Tranzscheliella halophiloides (G.W. Fischer) Vánky, **comb. nov.**

Basionym: *Ustilago halophiloides* G.W. Fischer, Res. Stud. State Coll. Wash. 20:9, 1952. — Type on *Distichlis stricta* (Torr.) Rydb., USA, Oregon, Albert Lake, 28.VII.1950, G.W. Fischer & R. Sprague. Isotypes in Fischer, Gramin. smuts N. Amer. no. 215, HUV 9945!

Sori surrounding the internodes, affecting all but the lowermost, first covered by a delicate, silvery membrane which flakes away disclosing the dark brown, powdery mass of spores. *Spores* globose, subglobose to ovoid, often depressed on one side, 4–6 µm long, yellowish-brown; wall even, c. 0.5 µm thick, without polar thickenings, minutely verrucose, spore profile smooth to finely wavy.

On Gramineae: *Distichlis stricta* (Torr.) Rydb.; N. America (USA).

The isotype in HUV (no. 9945), besides *T. halophiloides*, contains also plants with smooth spores, typical for *T. minima.*

Tranzscheliella jacksonii (Zundel & Dunlap) Vánky, **comb. nov.**

Basionym: *Ustilago jacksonii* Zundel & Dunlap, in Zundel, North American Flora 7:982, 1939b. — Type on *Stipa lettermanii* Vasey, USA, Colorado, Tolland, 13.VIII.1921, E. Bethel, BPI 162078, 162079.

Sori surrounding the upper internodes and the aborted inflorescence axis, covered only by the enveloping leaf sheaths, dark brown, powdery. *Spores* variable in shape and size, globose, subglobose, ovoid, oblong, 8–12 x 8–13.5(–16) µm, olivaceous-brown; wall evenly thick (0.8–1 µm), finely, densely verrucose, warts often fusing into irregular groups, spore profile nearly smooth to finely wavy.

On Gramineae: *Stipa lettermanii* Vasey; N. America (USA).

Tranzscheliella macrochloae (Pat.) Vánky, **comb. nov.**

Basionym: *Ustilago macrochloae* Patouillard, Bull. Soc. Mycol. France 22:199, 1906. — *Sphacelotheca macrochloae* (Pat.) Maire, 1916:279. — Type on *Stipa tenacissima* L., Tunisia, El Haffey, 25.III.1891, N. Patouillard 112, FH. Isotypes PC, HUV 14996!

For description see Vánky, 1994:365 & 415 (as *Ustilago macrochloae*).

On Gramineae: *Stipa tenacissima* L. (*Macrochloa tenacissima* (L.) Kunth); N. Africa (Algeria, Morocco, Tunisia).

Tranzscheliella minima (Arthur) Vánky, **comb. nov.**

Basionym: *Ustilago minima* Arthur, Iowa Agr. Coll. Dept. Bot. Bull. 1884:172, 1884. — Type on *Oryzopsis cuspidata* Benth. ex Vasey (= *O. hymenoides* (Roem. & Schult.) Ricker), USA, Iowa, Ames.

Sphacelotheca valesiaca Schellenberg, 1911:61. — Type on *Stipa pennata* L., Switzerland, Sitten, 1901, A. Volkart.

Ustilago stipae Ciferri, 1931:52. — Lectotype (design. by Hirschhorn, 1947:75) on *Stipa spartea* Trin., USA, Iowa, Ames, 9.VII.1892, F.C. Stewart. Isolectotypes in Seymour & Earle, Econ. fgi., Ser. C., no. 70, HUV 9662!

Sorosporium reverdattoanum Lavrov, 1934:86. — Type on *Lasiagrostis splendens* (Trin.) Kunth (= *Achnatherum splendens* (Trin.) Nevski), Kazakhstan, Semipalatinsk Prov., Buran, 7.VII.1928, N.N. Lavrov, LE. Isotype HUV 1210!

For description and illustrations see Vánky, 1994:366 & 418 (as *Ustilago minima*).

On Gramineae: *Achnatherum splendens* (Trin.) Nevski (*Stipa splendens* Trin., *Lasiagrostis splendens* (Trin.) Kunth), *Oryzopsis hymenoides* (Roem. & Schult.) Ricker (*O. cuspidata* Benth. ex Vasey), *Sitanion hystrix* (Nutt.) J.G. Smith, *Stipa blackii* C.E. Hubb., *S. dasyphylla* (Lindem.) Trautv., *S. eminens* Cav., *S. joannis* Celak., *S. mollis* R. Br., *S. occidentalis* Thurb., *S. pennata* L., *S. pulcherrima* C. Koch, *S. spartea* Trin., *S. stuposa* Hughes, *S. verticillata* Nees ex Spreng.; cosmopolitan.

Tranzscheliella sparti (Massenot) Vánky, **comb. nov.**

Basionym: *Ustilago sparti* Massenot, in Guyot, Malençon & Massenot, Rev. Pathol. Vég. Entomol. Agric. France 34:215, 1955. — Lectotype (design. by Vánky, 1994:376) on *Lygeum spartum* L., Tunisia, near Hadjeb-el-Aioun, 1.X.1953, L. Guyot, PC. Isolectotype HUV 15938!

For description and illustrations see Vánky, 1994:376 & 434 (as *Ustilago sparti*).

On Gramineae: *Lygeum spartum* L.; N. Africa (Algeria, Tunisia).

Tranzscheliella ventanensis (Hirschh.) Vánky, **stat. et comb. nov.**

Basionym: *Ustilago jacksonii* Zundel & Dunlap var. *ventanensis* Hirschhorn, Notas Mus. La Plata, Bot. 8:171, 1943. — Type on *Stipa* sp., Argentina, Prov. Buenos Aires, Sierra de la Ventana, La Pileta, 5.XI.1941, A.L. Cabrera 7343, Herb. E. Hirschhorn. Isotypes LPS 21560, HUV 15445!

Sori surrounding the upper internodes and the aborted inflorescence, naked, dark brown, powdery. *Spores* globose to ellipsoidal, 5–7 x 5.5–8(–9) µm, yellowish-brown; wall even, 1–1.5 µm thick, finely, densely verrucose, spore profile wavy, in SEM warts often confluent into irregular groups.

On Gramineae: *Stipa* sp.; S. America (Argentina).

Key to the *Tranzscheliella* species

1. Spores 8–13.5(–16) µm long.......... ***T. jacksonii***
– Spores smaller 2
2. Spores with conspicuous opercula. .... ***T. williamsii***
– Spores without conspicuous opercula but "polar caps" may be present 3
3. Spores verrucose 4
– Spores smooth, punctate or punctate-verruculose 5
4. Spores 4–6 µm long .... ***T. halophiloides***
– Spores 5.5–8(–9) µm long .... ***T. ventanensis***
5. Peridium around the sori present 6
– Peridium absent 8
6. Spores 3.5–6 µm long, polar caps absent .... ***T. minima***
– Spores 5.5–8 µm long, polar caps may be present 7
7. Spores smooth .... ***T. halophila***
– Spores punctate-verruculose .... ***T. macrochloae***
8. Spores 2.5–4.5(–5) µm long .... ***T. comburens***
– Spores larger 9
9. Spores 3.5–7 µm long, polar caps may be present. Sori on culms . ***T. hypodytes***
– Spores 5.5–8 µm long, polar caps absent. Sori in the inflorescence...... ***T. sparti***

THE *ENTYLOMA* SPECIES OF *BIDENS* (COMPOSITAE)

Several *Entyloma* species have been published on *Bidens*. The oldest name is *E. guaraniticum* Spegazzini (1884b), followed by *E. bidentis* Hennings (1895) and *E. bidentis* Spegazzini (1899). Saccardo and Sydow discovered the homonymy and renamed the fungus as *E. spegazzinii* Sacc. & P. Sydow (in Saccardo, 1902). Sawada (1922, n.v.), described an *Entyloma* on *Bidens pilosa* L. from Japan as *E. bidentis* Sawada (later homonym, not Hennings, 1895, not Spegazzini, 1899). Later, Sawada (1943:43) himself attributed the fungus to *E. bidentis* Henn., but Ling (1953b:344) considered it to be *E. guaraniticum* Speg. Ciferri (1928:38), published (invalidly, ICBN 34.1) the name of *E. incertum* Cif., "n. sp. ad interim", without any description (nom. nud.), on *Bidens chrysanthemoides* Michx. (= *B. laevis* (L.) B.S.P.). North American authors often treated the *Entyloma* species of *Bidens* (e.g. *B. frondosa* L., *B. laevis* (L.) B.S.P., *B. tenuisecta* Gray, *B. vulgata* Greene) under the collective name of *E. compositarum* Farlow (comp. G.W. Fischer, 1953:85). The following four *Entyloma*, including a new species, could be recognised on *Bidens*:

1. ***Entyloma bidentis*** Hennings, in Engler, 1895:49.

Type on *Bidens pilosa* L., Tanganyika Territory [= Tanzania], Mt. Kilimanjaro, Marangu, alt. 1500 m, V.1894, G. Volkens 2283, BR!

Sori on the leaves forming first whitish, later yellow to brown, flat, rounded to angular spots, 1–5 mm in diameter or larger by confluence. *Spores* embedded in the leaf tissue, globose, subglobose, ellipsoidal to irregular, 9–14 x 10–16 µm, subhyaline to pale yellowish-brown, content granular; wall even to slightly uneven, 1–1.5(–2.5) µm thick, smooth.

On *Bidens bipinnata* L., *B. chilensis* DC. (*B. leucantha* Willd.), *B. pilosa* L.; cosmopolitan in the tropics and subtropics.

2. ***Entyloma guaraniticum*** Spegazzini, 1884b:127.

Type on "Araliaceae ?" (= *Bidens pilosa* L.), Paraguay, Guarapi, XII.1882, B. Balansa 3731, LPS 3361! Isotypes in Roumeg., Fgi. gall. exs. no. 4031, HUV 1030!

Sori on the leaves, first as whitish, rounded spots, later yellowish or light brown, bullate, cup-shaped, hypertrophied areas, 1–5 mm in diam. With age, the host tissues in the central part of the sori become dark brown, necrotic and the sori may appear perforated. *Spores* embedded in the host tissue, subglobose, ellipsoidal to irregular, with one or two flattened sides, (8–)9–13 x 9–16 µm, subhyaline to pale yellow, content granular; wall uneven, 1–3(–4) µm wide, smooth.

On *Bidens bipinnata* L., *B. pilosa* L. and its var. *radiata* Schultz Bip.; N., C. & S. America, S. Africa, Australasia (Papua New Guinea).

E. guaraniticum was often mistaken for the more common *E. bidentis* Henn. However, besides spore wall thickness, the sorus morphology serves as a good differentiating character: sori flat in *E. bidentis*, bullate, cup-shaped in *E. guaraniticum*.

3. *Entyloma spegazzinii* Saccardo & P. Sydow, in Saccardo, 1902:376. *Entyloma bidentis* Spegazzini, 1899:211 (later homonym, non Hennings, 1895). — Type on *Bidens bipinnata* L., Argentina, Córdoba, XII.1887, C. Spegazzini.

Sori forming rounded, flat to slightly thickened leaf spots, 1–4 mm in diam. or larger by confluence, first pale, with indefinite margins, later brownish. *Spores* embedded in the leaf tissue, densely agglutinated, subglobose, ellipsoidal or irregular by mutual pressure, 9–16 x 12–20 µm, subhyaline, content homogenous; wall uneven, 2–5.5 µm thick, smooth.

On *Bidens bipinnata* L., *B. pilosa* L., *B. subalternans* DC.; S. America, C. & S. Africa.

4. *Entyloma frondosa* Vánky, sp. nov.

Typus in matrice *Bidens frondosa* L., Zambia, Southern Province, 162 km NE urbe Livingstone, 16°56'40" S, 26°48'12" E, alt. cca. 1270 m.s.m., 14.IV.2001, leg. C., T. & K. Vánky. Holotypus in Herbario Ustil. Vánky, HUV 19693, isotypi in Vánky, Ust. exs. no. 1142.

Sori sicut maculae rotundae, depressae foliorum, diametro 1–4 mm, primo pallide virides, serius in medio brunneae, in latere abaxiali foliorum proper conidia albidae. *Sporae* in telis foliorum innatae, satis dense situatae et variae, globosae, ovoideae usque irregulares, cum latere uno doplanato, (8–)9,5–14(–16) x 11–18(–20) µm, subhyalinae usque pallide flavidobrunneae; pariete inaequali, 1–3(–4) µm crasso, levi. *Anamorpha* praesens.

Sori (Fig. 1) as rounded, flat, leaf spots, 1–4 mm in diameter, first pale green, later brown in the centre, whitish on the abaxial side of the leaves due to conidia. *Spores* (Fig. 5) embedded in the leaf tissue, rather crowded and variable, globose, ovoid to irregular, with a flattened side, (8–)9.5–14(–16) x 11–18(–20) µm, subhyaline to pale yellowish-brown; wall uneven, 1–3(–4) µm thick, smooth. *Anamorph* present.

On *Bidens frondosa* L., C. Africa (Zambia). Probably, the North American "*Entyloma compositarum* Farlow" on *B. frondosa* represents also this species.

The main differentiating characters of the *Entyloma* species of *Bidens* are shown in a key.

Key to the *Entyloma* species of *Bidens*

1. Sori bullate, cup-shaped.. ***E. guaraniticum***
– Sori flat 2
2. Spores 12–20 µm long, wall 2–5.5 µm thick...............................***E. spegazzinii***
– Spores smaller, wall thinner...3
3. Spores 11–18(–20) µm long, wall 1–3(–4) µm thick......................***E. frondosa***
– Spores 10–16 µm long, wall 1–1.5(–2.5) µm thick .... ***E. bidentis***

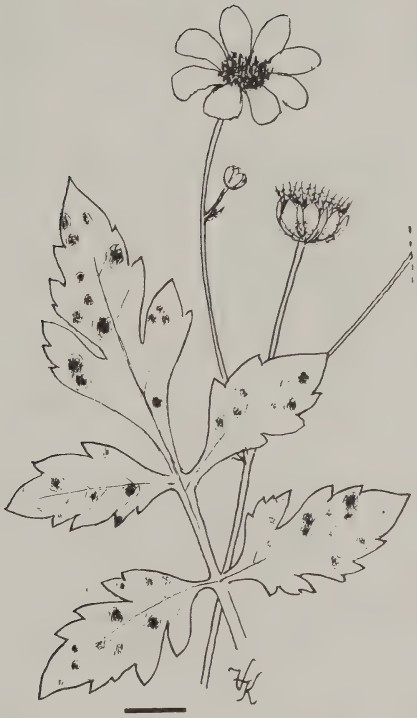

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Fig. 1. Sori of *Entyloma frondosa* Vánky on a leaf of *Bidens frondosa* L. (type). Bar = 1 cm.

THE SMUT FUNGI OF *PENNISETUM* (GRAMINEAE)

This is the third and last part of the smut fungi of the subtribe Cenchrinae (see Vánky, 1998:330-337, and 2002a:391-398).

Pennisetum Rich., with c. 80 species throughout the tropics, is not sharply delimited from *Cenchrus*. On *Pennisetum* at least 26 smut fungi have been reported. Several of them are taxonomic synonyms (see below). In some cases the host plant is not a *Pennisetum* or the fungus is not a smut. For example, *Tuburcinia penniseti* J.N. Mishra (type on *Pennisetum hordeoides* (Lam.) Steud., India) is a rust fungus, *Phakopsora apoda* (Pat. & Har.) Mains (Vánky, 1999:159). The 13 recognised smut fungi of *Pennisetum*, including three new species, are:

1. ***Moesziomyces bullatus*** (J. Schröter) Vánky, 1977:133.

Sorosporium bullatum J. Schröter, 1869:6. — Type on *Panicum crus-galli* L., Germany.

Tolyposporium senegalense Spegazzini, 1915:118. — Type on *Penicillaria typhoidea* (L. Rich.) Fig. & de Not. (= *Pennisetum glaucum* (L.) R. Br.), Senegal, Dakar, 8.XII.1913, C. Spegazzini, LPS 4553!

For description, further synonyms and illustrations see Vánky, 1994:163-166.

On species of *Echinochloa*, *Leersia*, *Panicum*, *Paspalum*, as well as on *Pennisetum glaucum* (L.) R. Br. (*P. americanum* (L.) Schum., *P. typhoideum* L. Rich.), and *P. purpureum* Schum.; cosmopolitan.

2. ***Sporisorium cenchri*** (Lagerh.) Vánky, 1985:114.

Ustilago cenchri Lagerh., in Patouillard & Lagerheim, 1895:62. — Type on *Cenchrus* sp., Ecuador, Riobamba, VIII.1891, G. Lagerheim, S!

Sorosporium chardonianum Zundel, 1942:125. — Type on *Pennisetum bambusiforme* (Fourn.) Hemsley ex B.D. Jackson, Venezuela, near Merida, alt. 1600 m., 4.XII.1936, C.E. Chardon, Myc. Explor. Venezuela no. 1844 III, BPI 195142! (syn. here).

Sorosporium texanum Zundel, 1944:409. — Type on *Pennisetum nervosum* (Nees) Trin., USA, Texas, Brownsville, Fort Brown, 23.XII.1942, Hansel 52794. Holotype BPI 180809!, isotypes BPI 180810, 195125. (syn. here).

For description, further synonyms and illustrations see Vánky, 1994:200 & 211, and 2002a:392.

On *Cenchrus brownii* Roem. & Schult., *C. ciliaris* L. (*Pennisetum ciliare* (L.) Link; *Pennisetum cenchroides* Rich.), *C. echinatus* L., *C. gracillimus* Nash, *C. incertus* M.A. Curtis (*C. carolinianus* Walt.), *C. myosuroides* H.B.K., *C. pauciflorus* Benth., *C. pilosus* H.B.K. (*C. tribuloides* auctt. eur. non L.), ?*Panicum* species, *Pennisetum bambusiforme* (Fourn.) Hemsley ex B.D. Jackson, and *P. nervosum* (Nees) Trin.; cosmopolitan.

Study of the types of ***Sorosporium chardonianum*** Zundel, and ***S. texanum*** Zundel revealed that they are identical with *Sporisorium cenchri*.

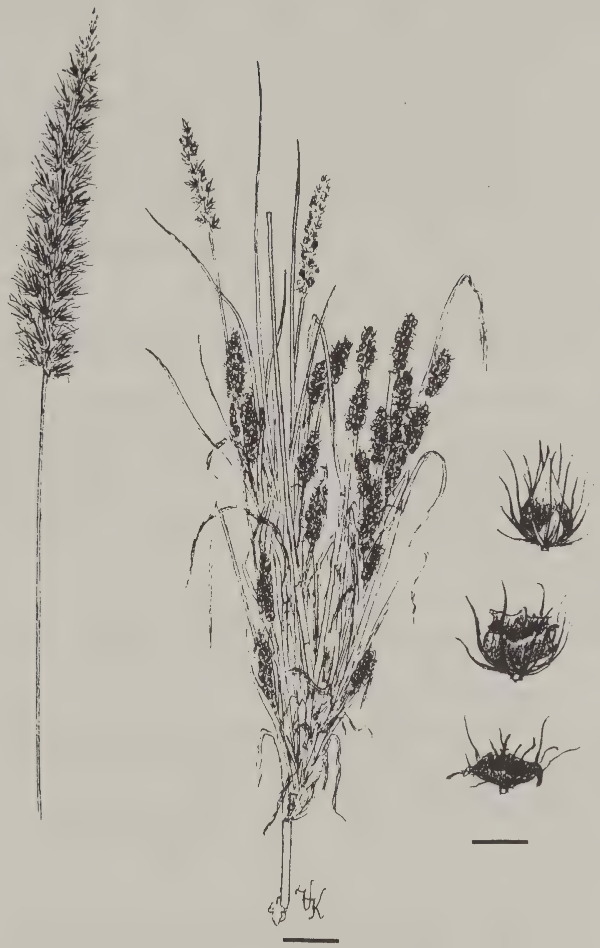

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Fig. 2. Sori of *Sporisorium dubiosum* (Zundel) Vánky producing stunting and witches' brooms on *Cenchrus ciliaris* L. (*Pennisetum cenchroides* Rich.; Namibia, HUV 19680). Habit. To the left a healthy inflorescence. Enlarged, three spikelets with sori of different developmental stages.

Bars = 1 cm for habit, 2 mm for the detail drawings.

3. ***Sporisorium divisum*** **Vánky, sp. nov.**

Typus in matrice *Pennisetum divisum* (Forssk. ex Gmel.) Henr., W. Pakistan, Mankera prope Bhakkar, 21.XI.1976, leg. S. Ahmad. Holotypus in Herbario Ustil. Vánky, HUV 9009!

Sori in spiculis, cylindrici, 1,5–3 x 4–12 mm, primo peridio pallide brunneo cooperti, quo irregulariter rupto massam semiagglutinatam usque pulveream glomerulorum sporarum et columellas 4–6, sat crassas, apicaliter tenuiescentes, saepe breviter ramificatas ostendentes. Spiculae omnes eiusdem spicae infectae. *Glomeruli sporarum* globoidei, ellipsoidales, elongati usque irregulares, 30–80 x 40–90 µm, atro-rufobrunnei, e sporis multis, faciliter separabilibus compositi. *Sporae* subglobosae, ellipsoidales usque subpolyedrice irregulares, 8–10,5 x 9–12 µm, flavidobrunneae; pariete aequaliter crasso (cca. 1 µm), conspicue levi usque leniter, dense punctato.

Sori (Fig. 10) in the spikelets, cylindrical, 1.5–3 x 4–12 mm, first covered by a pale brown peridium which ruptures irregularly disclosing the semiagglutinated to powdery mass of spore balls and 4–6, rather stout, apically narrowing, often shortly ramifying columellae. All spikelets in a spike are infected. *Spore balls* (Figs. 6, 7) globoid, ellipsoidal, elongated to irregular, 30–80 x 40–90 µm, dark reddish-brown, composed of numerous, easily separating spores. *Spores* (Figs. 6, 7) subglobose, ellipsoidal to subpolyhedrally irregular, 8–10.5 x 9–12 µm, yellowish-brown; wall evenly thick (c. 1 µm), apparently smooth to finely, densely punctate.

On *Pennisetum divisum* (Forssk. ex Gmel.) Henr. (*P. dichotomum* (Forssk.) Delile); S. Asia (W. Pakistan). Known from the type collection only.

4. ***Sporisorium dubiosum*** (Zundel) Vánky, 2002a:396.

Cintractia dubiosa Zundel, 1931:299. — Type on *Pennisetum* sp. (= *Cenchrus ciliaris* L., teste K. Vánky), Kenya, Nairobi, 9.IX.1920, H.L. Shantz. Holotype in BPI 171508!, isotypes in BPI 171509 and 171510.

For revised description see Vánky, 2002a:396. See also Fig. 2.

On *Cenchrus ciliaris* L. (*Pennisetum cenchroides* Rich.); E. & S. Africa (Kenya, Namibia).

5. ***Sporisorium ehrenbergii*** (Kühn) Vánky, 1990:270.

Sorosporium ehrenbergii Kühn, 1877:87. — *Tolyposporium ehrenbergii* (Kühn) Patouillard, 1903:254. — Type on *Sorghum cernuum* (Ard.) Host (= *S. bicolor* (L.) Moench), Egypt, Cairo.

For description and illustrations see Vánky, 1994:201 & 213.

On *Sorghum bicolor* (L.) Moench. Recently, a morphologically identical fungus was collected on *Pennisetum glaucum* (L.) R. Br. (*P. typhoideum* L. Rich.) in Eritrea (HUV 19512, det. K. Vánky), which is under investigation; Africa, Asia.

6. ***Sporisorium penniseti*** (Rabenh.) Ershad, 1994:18.
Ustilago penniseti Rabenhorst, 1871:18. — *Sphacelotheca penniseti* (Rabenh.) Reichert, 1921:679. — Neotype (design. by Vánky, 2000:211) on *Pennisetum orientale* L. C. Richard, "Taurus Catasnicus, 1865", C. Haussknecht, JE!

Ustilago pappiana Baccarini, 1906:272. — *Sorosporium pappianum* (Bacc.) L. Ling, 1953a:192. — Lectotype (design. by Ling, 1953a:192) on *Pennisetum ruppellii* Steud. (= *P. setaceum* (Forssk.) Chiov.), Eritrea-Amasen, Addi-Baró, along the river Mareb, 29.X.1902 (as "22.XI.1902"), A. Pappi, FT (RO 6168)! Syntype on *Pennisetum orientale* Rich. [var. *altissimum* Chiov.] (= *P. setaceum*), Eritrea, Ingal-Ceccaharat near Oculé-Cusai, alt. c. 1600 m, 22.III.1893 (as "22.IV.1893"), A. Pappi, FT (RO 4797)! (syn. here).

Sorosporium catharticum Maire, 1931:359. — *Sporisorium catharticum* (Maire) Vánky, 1989:155. — Type on *Cenchrus catharticus* Delile (= *C. biflorus* Roxb.), Algeria, South Sahara, near Tilemsi, coll. T. Monod 467, MPU! (syn. by Vánky, 2000:211).

Sphacelotheca panjabensis H. Sydow, in Sydow & Ahmad, 1939:442. — *Ustilago panjabensis* (H. Sydow) L. Ling, 1950:76. — Type on "*Cenchrus biflorus* Roxb." (= *C. setigerus* Vahl, teste K. Vánky), India, Punjab, Sargodha, sine die, leg. S. Ahmad 33, HUV 17298! (syn. by Vánky, 2002a:397).

Sorosporium penniseti Mundkur, 1939:116. — Type on *Pennisetum ciliare* (L.) Link (= *Cenchrus ciliaris* L.), India, Delhi, 3.VIII.1938, M.A. Khan. Holotype HCIO 7749!, isotype IMI. (syn. by Vánky, 2000:211).

Sphacelotheca stewartii Mundkur, 1944a:290. — Type on *Pennisetum flaccidum* Grieseb., Kashmir, Baltistan, on the way from Kasurmik to Doghani, alt. 9000 ft, 16.VIII.1940, R.R. Stewart 20793. Holotype HCIO 10017, isotype HUV 17309! (syn. here).

Ustilago penniseti Rabenh. var. *verruculosa* Massenot, in Guyot, Malençon & Massenot, 1969:217. — Type on *Pennisetum ciliare* (L.) Link, Morocco, near Atchana, Valley of Oued Guir, 12.VI.1932, G. Malençon 140. Holotype PC, isotype HUV 13658! (syn. by Vánky, 2000:211).

Sori in the spikelets, cylindrical, 1–1.5 x 2–7 mm, hidden by the glumes, covered with a greyish-brown peridium which flakes away exposing the semi-agglutinated to granular-powdery mass of spore balls and a central columella with a few, short, apical branches. All spikelets in a spike are infected. *Spore balls* globose, ovoid to ellipsoidal, 40–110 µm long, dark reddish-brown, composed of many spores which separate rather easily. *Spores* dimorphic; those on the periphery of the balls globose to ellipsoidal, 9–13 x (9–)10–13.5(–14.5) µm, medium reddish-brown, finely and densely echinulate, those in the centre subpolyhedral, smaller (7–10 µm), lighter coloured and finely punctate or apparently smooth. *Sterile cells* of the peridium variable in shape and size, often elongated, 4–16 µm long, arranged in parallel rows, hyaline, smooth.

On *Cenchrus biflorus* Roxb. (*C. catharticus* Delile), *C. ciliaris* L. (*Pennisetum ciliare* (L.) Link), *C. prieurii* (Kunth) Maire (*Pennisetum prieurii* Kunth; *P. cenchroides* Rich.), *C. setigerus* Vahl (*C. biflorus* auct. non Roxb.), *Pennisetum flaccidum* Griseb., *P. macrourum* Trin., *P. natalense* Stapf, *P. orientale* Rich. (*P. fasciculatum* Trin.), *P. setaceum* (Forssk.) Chiov. (*P. orientale* Rich. var. *altissimum* Chiov.; *P. ruppellii* Steud.); S. Europe (Mediterranean area), Africa (incl. Madagascar), S. Asia.

Study of the type of ***Ustilago pappiana*** Bacc., and that of ***Sphacelotheca stewartii*** Mundkur revealed that they are identical with, and synonyms of *Sporisorium penniseti* (Rabenh.) Ershad.

In the original description of *Ustilago penniseti* (Rabenhorst, 1871:18), the spores are globose, smooth, 9–11 µm in diam. Baccarini, 1906:272, describing *U. pappiana*, wrote that it differs from *U. penniseti* in having larger spores (12–15 µm) and no columella. The spore measurements given for *U. penniseti* are too small (comp. the description above) and those of *U. pappiana* too large (comp also Ling, 1953a:192). A columella, typical for *Sporisorium penniseti*, is also present in the sori of *U. pappiana*. Small variations (± 1 µm) in the spore measurements may occur in samples from different host plant species or from different geographical areas.

7. *Sporisorium penniseti-japonici* (Hennings) Vánky,
in Vánky & Guo, 1986(1987):234.

Ustilago penniseti-japonici Hennings, 1904:140. — *Sphacelotheca penniseti-japonici* (Henn.) S. Ito, 1935:91. — Type on *Pennisetum japonicum* Trin. ex Spreng. (= *P. alopecuroides* (L.) Spreng.; *P. purpurascens* (Thunb.) Makino), Japan, Tokyo, 25.IX.1900, Kusano 443. Isotype in HUV 15794!

Ustilago penniseti Rabenh. var. *tonkinensis* Patouillard, 1890:57. — Type on *Pennisetum* sp. (= *P. alopecuroides* (L.) Spreng., teste K. Vánky), Indochina [= North Vietnam], Tonkin Region, Mts. of Elephants, I.1886, B. Balansa, FH! (syn. here).

Ustilago penniseti Saccardo, 1921:596. — Type on *Pennisetum* sp., China, Fukien, Foochow, VI.1918, Skvortzow 3962 (later homonym, not Rabenh., 1871:18; syn. by Ling, 1953b:344).

Sori in the central part of the spikelets, infecting all spikelets in the inflorescence, ellipsoidal, 1.5–2 x 5–7 mm, more or less hidden by the outermost floral envelopes and the bristles, first covered by a pale brown peridium which ruptures from its apex disclosing the first agglutinated later granular powdery mass of spore balls and spores surrounding several flagelliform columellae about the length of the sorus. *Spore balls* globoid, ellipsoidal, oblong, irregular, 40–80 x 50–100 µm, reddish-brown, composed of tens of spores which separate easily by pressure. *Spores* subglobose, ovoid, ellipsoidal to subpolyhedrally irregular, 10.5–13.5(–14.5) x 12–15(–16) µm, yellowish-brown; wall slightly uneven, 0.5–1 µm thick, densely verrucose-echinulate, spore profile undulate to finely serrulate. *Sterile cells* absent.

On *Pennisetum alopecuroides* (L.) Spreng. (*P. purpurascens* (Thunb.) Makino; *P. japonicum* Trin. ex Spreng.); E. Asia (Japan, N. Vietnam).

Study of the type of ***Ustilago penniseti*** Rabenh. var. ***tonkinensis*** Pat. revealed that the host plant is *Pennisetum alopecuroides*, and its smut identical with *Sporisorium penniseti-japonici*.

8. ***Sporisorium pennisetinum*** (S. Ahmad) Vánky, **comb. nov.**

Basionym: *Sphacelotheca pennisetina* S. Ahmad, Mycol. Pap. 64:7, 1956. — Type on *Pennisetum flaccidum* Grieseb., Pakistan, Swat State, Madian, 14.VIII.1952, S. Ahmad 4596, IMI 57436!

Sori destroying the whole inflorescence, first covered by a peridium which ruptures to expose the dark brown, powdery mass of spores intermixed with groups of sterile cells, and numerous filiform columellae. *Spores* when mature single, subglobose, ovoid, ellipsoidal to slightly subpolyhedrally irregular, 9–13 x 10–14.5(–16) µm, yellowish-brown; wall even, c. 0.5 µm thick, densely, finely verrucose-echinulate; spore profile finely serrulate. *Sterile cells* in irregular groups, collapsed in old specimen, single cells 7–14 µm long, subhyaline to pale yellowish-brown.

On *Pennisetum flaccidum* Grieseb.; S. Asia (Pakistan). Known only from the type collection.

9. ***Sporisorium sphacelatum*** Vánky, **sp. nov.**

Typus in matrice *Pennisetum sphacelatum* (Nees) Dur. & Schinz., South Africa, East Cape Province, Mts. Drakensberg, inter oppid. Barkley East et Lady Grey, 30°43'08" S, 27°20'50" E, alt. cca. 960 m, 22.XII.1996, leg. C. & K. Vánky. Holotypus in Herbario Ustil. Vánky, HUV 19733, isotypi in Vánky, Ust. exs. no. 1145. Paratypus in matrice *P. sphacelatum*, Lesoto, Leribe Distr., Nkaobee Pass, cca. 15 km N Katse Dam Wall, 29°18'57" S, 28°32'10" E, alt. cca. 2400 m, 25.XII.1996, leg. C. & K. Vánky, HUV 19734.

Sori inflorescentiam totam destruentes, longe cylindrici, 1–3 x 40–150 mm, a vagina folii supremi protrudentes, primo peridio cinerascentibrunneo cooperti, quo longitudinaliter rupto massam atrobrunneam, pulveream glomerulorum sporarum et sporarum cum columellis nonnullis, longis, filiformibus immixtarum ostendentes. *Glomeruli sporarum* globosi, ellipsoidales, elongati usque irregulares, 30–80(–90) x 40–150(–190) µm, atro-flavidobrunnei usque subopaci, e sporis pluries decem usque pluries centum facile secedentibus compositi. *Sporae* subglobosae, ellipsoidales, raro parum irregulares, 5–6,5 x 5,5–7,5 µm, flavidobrunneae, ad latus unum pallidiores; pariete inaequaliter crasso, 0,5–0,8 µm, ad dimidium pallidum tenuiore, subtiliter, dense punctato-verruculoso; imago obliqua sporarum levis. *Cellulae steriles* non observatae.

Sori (Fig. 3) destroying the whole inflorescence, long cylindrical, 1–3 mm x 4–15 cm, protruding from the uppermost leaf sheath, at first covered by a greyish-brown peridium which ruptures longitudinally disclosing the dark brown, powdery mass of spore balls and spores intermixed with several, long, filiform columellae. *Spore balls* (Figs. 8, 9) globose, ellipsoidal, elongate to irregular, 30–80(–90) x 40–150(–190) µm, dark yellowish-brown to subopaque, composed of tens to hundreds of easily separating spores. *Spores* (Figs. 8, 9) subglobose, ellipsoidal, rarely slightly irregular, 5–6.5 x 5.5–7.5 µm, yellowish-brown, paler on one side; wall unevenly thick, 0.5–0.8 µm, thinner on the pale half, finely, densely punctate-verruculose; spore profile smooth. *Sterile cells* not seen.

On *Pennisetum sphacelatum* (Nees) Dur. & Schinz.; S. Africa (Lesoto, South Africa). Known only from the type collections.

10. *Sporisorium tothii* Vánky, sp. nov.

Typus in matrice *Pennisetum glaucum* (L.) R. Br., Sierra Leone, Central Province, Njala, XII.1929, leg. C.F. Deighton. Holotypus in Herbario Ustil. Vánky, HUV 7114, isotypus in BPI 192487.

Sori in ovariis nonnullis inflorescentiae eiusdem, obovoidei vel globoidei, pedicellati, 1,5–2,5 x 3–4,5 mm, cum apice brevi, acuto, peridio crasso, atrobrunneo cooperti, quo irregulariter rupto massam atrobrunneam, primo agglutinatam, deinde granulosopulveream glomerulorum sporarum columellam brevem, simplicem, complanatam circumdantem ostendentes. *Glomeruli sporarum* subglobosi, ellipsoidales, elongati, plerumque irregulares, 40–120 x 50–140(–190) µm, atro-flavidobrunnei usque subopaci, e sporis pluries decem usque pluries centum, pressione separabilibus compositi. *Sporae* globosae, ovoideae, ellipsoidales usque parum irregulares, 7–9,5 x 8–11(–12) µm, flavidobrunneae; pariete aequali, cca. 0,5 µm crasso, levi. *Cellulae steriles* nullae.

Sori (Fig. 4) in some ovaries of an inflorescence, obovoid or globoid, 1.5–2.5 x 3–4.5 mm, with a pedicel and a short acute tip, covered by a thick, dark brown peridium which ruptures irregularly disclosing the first agglutinated, later granular-powdery, dark brown mass of spore balls surrounding a short, simple, flattened columella. *Spore balls* (Figs. 15, 16) subglobose, ellipsoidal, elongate, usually irregular, 40–120 x 50–140(–190) µm, dark yellowish-brown to subopaque, composed of tens to hundreds of spores which separate by pressure. *Spores* (Figs. 15, 16) globose, ovoid, ellipsoidal to slightly irregular, 7–9.5 x 8–11(–12) µm, yellowish-brown; wall even, c. 0.5 µm thick, smooth. *Sterile cells* absent.

On *Pennisetum glaucum* (L.) R. Br. (*P. typhoideum* L. Rich), cultivated; W. Africa (Sierra Leone). Known only from the type collection.

Etymology: This fungus is named in the honour of my friend of more than half a century, Dr. Sándor Tóth (83; Gödöllő, Hungary), an exceptional, helpful, modest human being, who despite losing his arm in the Second World War, became the best contemporaneous specialist of Hungarian microfungi.

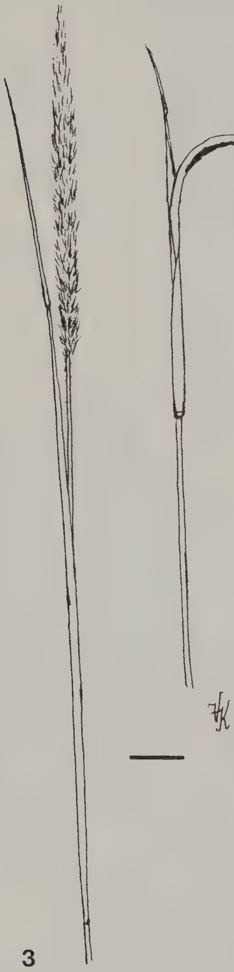
11. *Tilletia barclayana* (Bref.) Sacc. & P. Sydow, in Saccardo, 1899:422, s. lat.

Neovossia barclayana Brefeld, 1895:170. — Type on *Pennisetum triflorum* Nees, India, Himachal Pradesh, Simla, coll. A. Barclay.

Tilletia pennisetina H. Sydow, 1929:421. — Type on *Pennisetum alopecuroides* (L.) Spreng., China, Kiangsi Prov., Kuling, coll. F.L. Tai 2201.

Tilletia ajrekari Mundkur, 1939:103. — Type on *Pennisetum typhoides* Stapf, India, Ahmedabad, in experimental plots, 2.IX.1933, S.L. Ajrekar, HCIO.

Neovossia macrospora Petrak, 1947:114. — Type on *Pennisetum japonicum* Trinius ex Spreng. (= *P. alopecuroides* (L.) Spreng.), China, Chinkiang, X.1921, K. Kolthoff 33.



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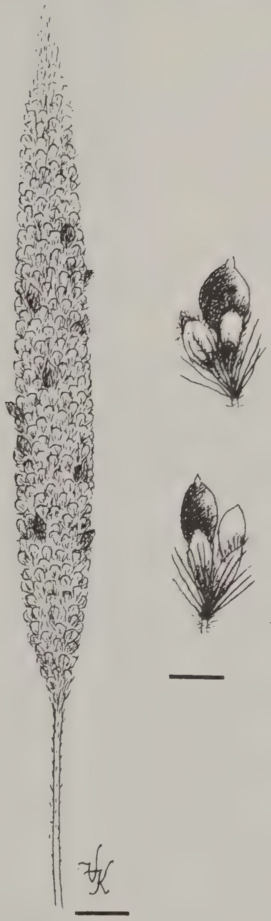

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Fig. 3. Sori of *Sporisorium sphacelatum* Vánky in the inflorescence of *Pennisetum sphacelatum* (Nees) Dur. & Schinz (type). Habit, and to the left a healthy inflorescence. Bar = 1 cm.

Fig. 4. Sori of *Sporisorium tothii* Vánky in some ovaries of *Pennisetum glaucum* (L.) R. Br. (type). Habit, and enlarged two spikelets, each with a sorus and a healthy seed. Bars = 1 cm for habit, 3 mm for the detail drawing.

Sori in some ovaries of an inflorescence, swollen, obovoid or ellipsoidal, 3–6 mm long, partly hidden by the glumes, first covered by a thick, dark brown membrane (pericarp) which ruptures from its apex disclosing the black, pulverulent mass of spores intermixed with sterile cells. *Spores* globose, subglobose to broadly ellipsoidal, 14–36 µm long (including ornamentation), reddish-brown to subopaque, provided with densely situated, truncate, 1.5–4 µm long warts ("scales"). *Sterile cells* variable in number, shape and size, globose, ellipsoidal or irregular, 10–30 µm in diameter, pale yellowish-brown, wall 1.5–4 µm thick, laminated or not, sometimes with a mycelial appendage.

On *Oryza sativa* L., *Panicum hians* Ell., *P. obtusum* H.B.K., *Paspalum distichum* L., *Pennisetum alopecuroides* (L.) Spreng., *Pe. orientale* Rich., *Pe. triflorum* Nees, *Pe. typhoides* Stapf; Asia, Indonesia, N. America.

There are variations in the measurements and colour of the spores, in the height of spore ornamentation and number of sterile cells between different collections on the same or on different host plants. Tullis & Johnson (1952), demonstrated by artificial infections that this depends also on the infected host plant. Therefore, they concluded that *Neovossia horrida, N. barclayana* and *Tilletia pennisetina* represent the same species. This view was adopted also by Durán & Fischer (1961:35).

12. ***Ustilago bahuichivoensis*** Durán, 1970:1102.

Type on *Pennisetum pringlei* Leeke, Mexico, Chihuahua, 1 mi. E. of Bahuichivo, 13.X.1969, J.F. Hennen. Holotype WSP 58559, isotype HUV 14508!

Ustilago beckeropsidis Zambettakis, 1979(1980):406. — Type on *Beckeropsis uniseta* (Nees) Schum. (= *Pennisetum unisetum* (Nees) Benth.), Belgian Congo [= Democratic Rep. of Congo], 1913, H.J.R. Vanderyst. The holotype is probably lost, it is not in BR or in PC. Paratypes: Sierra Leone, 8.I.1951, T.S. Jones, IMI 45383!, and Sudan, 17.X.1952, J.K. Jackson, IMI 51127! (syn. here).

Sori (Fig. 11) on the inner surface of the uppermost, hypertrophied, hispid leaf sheaths, fusiform, 1–3 cm wide, 3–8 cm long, partly hidden by healthy leaf sheaths, at maturity fissure longitudinally exposing the dark chocolate-brown, powdery mass of spores. *Spores* ovoid, ellipsoidal, elongate, rarely subglobose, 5–7(–8) x 6.5–10.5(–11) µm, yellowish-brown; wall even, c. 0.5 µm thick, finely, densely punctate, spore profile smooth, in SEM finely verrucose.

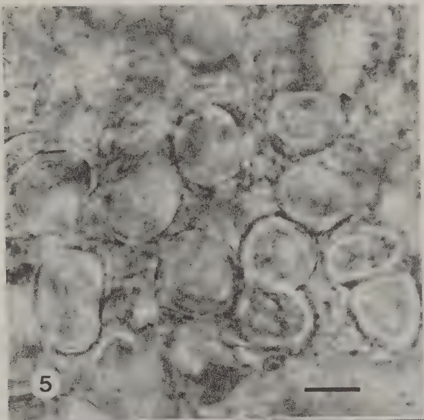
On *Pennisetum pringlei* Leeke, and *P. unisetum* (Nees) Benth. (*Beckeropsis uniseta* (Nees) K. Schum.); N. America (Mexico), Africa (Congo, Sierra Leone, Sudan).

Fig. 5. Spores of *Entyloma frondosa* Vánky on *Bidens frondosa* L., in LM (type).

Figs. 6, 7. Spores of *Sporisorium divisum* Vánky on *Pennisetum divisum* (Forssk. ex Gmel.) Henr., in LM and in SEM (type).

Figs. 8, 9. Spore balls and spores of *Sporisorium sphacelatum* Vánky on *Pennisetum sphacelatum* (Nees) Dur. & Schinz, in LM and in SEM (type).

Bars = 10 µm.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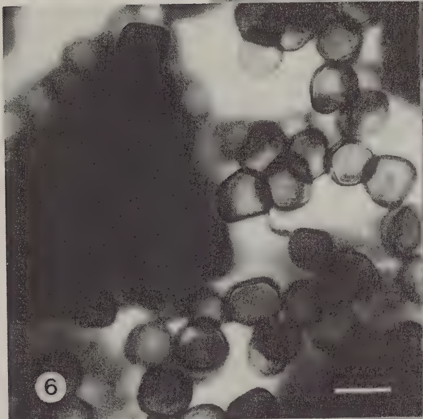
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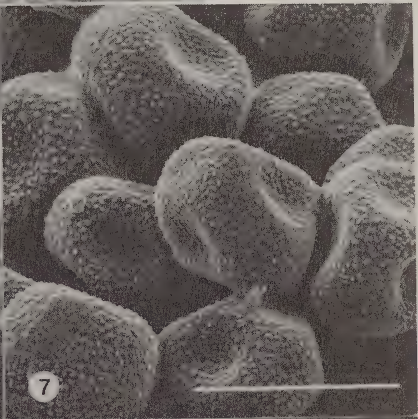
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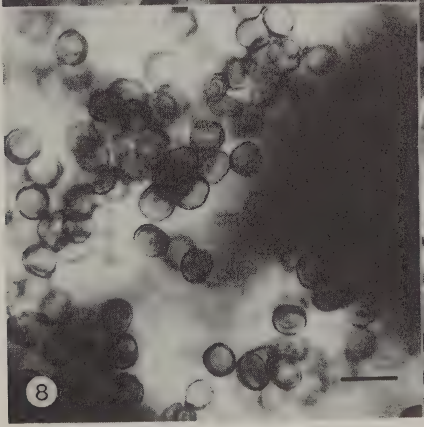
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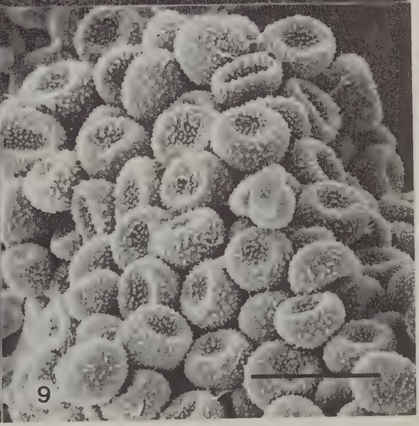
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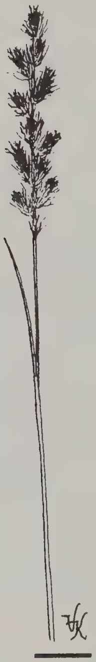

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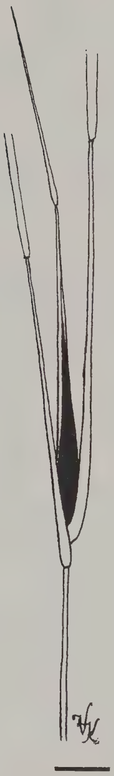

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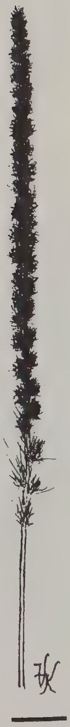

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Fig. 10. Sori of *Sporisorium divisum* Vánky, in the spikelets of *Pennisetum divisum* (Forssk. ex Gmel.) Henr. (type).

Fig. 11. Sori of *Ustilago bahuichivoensis* Durán, on the inner surface of the uppermost, hypertrophied leaf sheath of *Pennisetum pringlei* Leeke (type).

Fig. 12. Sori of *Ustilago kamerunensis* H. & P. Sydow, destroying all spikelets of an inflorescence of *Pennisetum purpureum* Schum. (Uganda, HUV 19977).

Bars = 1 cm.

Study of the paratypes of ***Ustilago beckeropsidis*** Zambett. revealed that it is identical with and a synonym of *U. bahuichivoensis* Durán.

13. *Ustilago kamerunensis* H. & P. Sydow, 1911:262.

Type on *Pennisetum* sp., Cameroon, Djutitsa's, XII.1908, Ledermann.

Sori (Fig. 12) destroying all the spikelets in the inflorescence, leaving intact only groups of long bristles and the inflorescence axis, 3–10 x 40–110 mm, first covered by a thin, greyish membrane which ruptures disclosing the blackish-brown, powdery mass of spores. *Spores* subglobose, ellipsoidal, often hemispherical with a more or less depressed side, in facial view 6.5–7 x 6.5–8 µm, in lateral view 4–5 µm wide, yellowish-brown; wall c. 0.5 µm, thinner on the flattened side, apparently smooth to extremely finely punctate.

On *Pennisetum purpureum* Schum. (*P. benthamii* Steud.), *P.* sp.; C. & E. Africa (Cameroon, Congo, Kenya, Rwanda, Uganda).

Not on *Pennisetum*

Ustilago bonariensis Speg. (= *Sporisorium panici-leucophaei* (Bref.) M. Piepenbr.). Lectotype on *Panicum spectabile* Nees, Argentina. According to Zundel, 1953:54, *Pennisetum tristachyum*, one of the syntypes, seems to be a misdetermination.

Ustilago scheffleri H. & P. Sydow, 1911:262.

Type on "*Pennisetum inclusum* Pilger", "Massaihochland, Lamuru" [?= Kenya, Kiambu Distr., Limuru], alt. 3000 m, 30.VI.1909, G. Scheffler 293. Isotypes in BPI 166232, 194468, K, M, HUV 12741!

The host plant is not a *Pennisetum* but a *Panicum* (teste K. Vánky; = *P. coloratum* L., det. H. Scholz, B). The fungus is a *Sporisorium* sp., maybe one of the about 20 *Sporisorium* species reported on *Panicum*. The *sori* destroy the whole inflorescence, are up to 3 cm long, first covered by a thin, greyish peridium which ruptures disclosing the dark brown, powdery mass of spores surrounding several, long, filiform columellae. *Spores* ellipsoidal, ovoid, more rarely globose or slightly irregular, (6.5–)7–9.5 x 8–12 µm, yellowish-brown; wall even, 0.5–0.8 µm thick, finely, densely punctate-verrucose, spore profile smooth to very finely wavy.

In the original description, the spores are given as reticulate. Zundel (1953:197) studied the type and wrote that the spores are "smooth but contents with a semi-reticulate, granular pattern (not reticulate as originally given)".

Sporisorium pamparum (Speg.) Vánky, in Vánky & Guo, 1986(1987):234. Type on *Setaria* sp., Argentina. It was reported on *Panicum*, *Pennisetum* and *Setaria* species. Specimens on *Pennisetum alopecuroides* (L.) Spreng. represent *Sporisorium penniseti-japonici* (Henn.) Vánky. Those on *Pennisetum flaccidum* Griseb. (e.g. in Vánky & Guo, 1986(1987):234) are very similar to, if not identical with *S. penniseti* (Rabenh.) Ershad, which has priority. Further studies are needed to elucidate possible conspecificity of *S. pamparum* with *S. penniseti*.

Key to the smut fungi of *Pennisetum*

(*M.* = *Moesziomyces*, *S.* = *Sporisorium*, *U.* = *Ustilago*)

1. Sori restricted to the ovaries 2
– Sori not restricted to the ovaries...5
2. Spores single, 14–36 µm in diameter .... ***Tilletia barclayana***
– Spores forming spore balls, smaller 3
3. Spores in the balls mixed with sterile cells. Columella absent......... ***M. bullatus***
– Spores in the balls not mixed with sterile cells. Columella present..................4
4. Columella one, short. Spores all alike, 8–11(–12) µm long, smooth...... ***S. tothii***
– Columellae several, filiform. Spores dimorphic, 9.5–15 µm long, outer spores verrucose .... ***S. ehrenbergii***
5(1). Sori on the inner surface of the uppermost leaf sheaths .. ***U. bahuichivoensis***
– Sori not so 6
6. Sori destroying the whole inflorescence...7
– Sori restricted to the spikelets 9
7. Spores 5.5–7.5 µm long.. ***S. sphacelatum***
– Spores larger...8
8. Spores 8–12(–13) µm long, slightly dimorphic .... ***S. cenchri***
– Spores 10–14(–16) µm long, not dimorphic............................ ***S. pennisetinum***
9(6).Columella and spore balls absent. Spores 6.5–8 µm long.... ***U. kamerunensis***
– Columella and spore balls present. Spores larger 10
10.Plants stunted, forming witches' brooms. Spores 7–11 µm long .... ***S. dubiosum***
– Plants not so. Spores larger...11
11.Columella one, stout. Spores (9–)10–13.5(–14.5) µm long............ ***S. penniseti***
– Columellae several 12
12.Spores 9–12 µm long .... ***S. divisum***
– Spores 12–16 µm long.. ***S. penniseti-japonici***

THE SMUT FUNGI OF *CYMBOPOGON* (GRAMINEAE)

Cymbopogon Spreng., in the subfam. Panicoideae, tribe Andropogoneae, subtribe Andropogoninae, is a fairly homogeneous genus of c. 40 species in the Old World tropics and subtropics; some species are introduced to tropical America (Clayton & Renvoize, 1986:351). At least 29 smut fungi have been reported on it under different generic names (*Sorosporium*, *Sphacelotheca*, *Sporisorium*, *Tolyposporium*, *Ustilago*), which all belong to the genus *Sporisorium*. Several are considered to be synonyms. The 13 recognised species, including two new ones, are:

1. *Sporisorium barberi* (Mundkur) Vánky, comb. nov.

Basionym: *Ustilago barberi* Mundkur, Trans. Brit. Mycol. Soc. 23:98, 1939. — *Sorosporium barberi* (Mundkur) L. Ling, 1951a:44. — *Farysia barberi* (Mundkur) Zundel, 1953:40. — Type on *Cymbopogon coloratus* (Nees) Stapf, India, Madras, Tinnevelly Distr., Palamcotta, 11.V.1901, C.A. Barber 2677, HCIO 7398. Isotypes in BPI 170200, IMI, HUV 17331!

Sorosporium cornutum M.S. Pavgi & Thirum., in Thirumalachar & Pavgi, 1956:282. — Type on *Cymbopogon confertiflorus* (Steud.) Watson, India, Wynaad, Panora, 17.XI.1909, W. McRae, HCIO. Isotype IMI 44440! (syn. here).

Sori destroying the innermost floral organs transforming them into tough, horn-shaped bodies, 1–2 x 5–25 mm, first covered by a thick, brown, smooth peridium which later splits longitudinally disclosing the semiagglutinated to powdery, dark brown mass of easily disintegrating spore balls and spores surrounding several (3–7) tapering columellae. The fungus usually produces proliferation of the infected spikelets and the sori are agglomerated like witches' brooms. *Spores* globose, subglobose, ovoid or subpolyhedrally slightly irregular, more or less variable in size, 7–12 x 8–13 µm, yellowish- to reddish-brown; wall evenly or unevenly thick, 0.5–1.5 µm, provided with sparsely situated, rounded, coarse warts, in SEM appearing as tubercles.

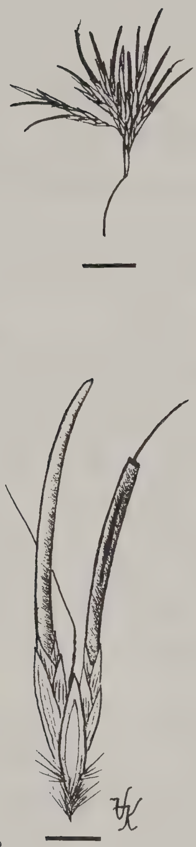
On *Cymbopogon coloratus* (Nees) Stapf, *C. flexuosus* (Nees ex Steud.) Watson, *C. nardus* (L.) Rendle var. *confertiflorus* (Steud.) Stapf ex Bor (*C. confertiflorus* (Steud.) Stapf); S. Asia (India).

There are rather big variations in the size of the spores between different collections, and in some collections even within the same sorus. E.g., the spore diameter of the globoid spores in the type of *Sporisorium barberi* varies between 6.5 and 12 µm. The spores of the HUV 8903 specimen (on *Cymbopogon coloratus*, India, Kerala, at Lake Periyar, 5.II.1980, K. Vánky) are more uniform, the globoid spores measuring 10–13 µm. In the type of *Sorosporium cornutum*, the spores are also uniform but smaller, measuring (7–)8–9.5(–10.5) x 8–11 µm. However, the typical sori and the even more typical spores, provided with sparsely situated tubercles, present in all these collections, make the identification easy. Despite the differences in spore measurements, I consider ***Sorosporium cornutum*** to be a synonym of *Sporisorium barberi*.

2. *Sporisorium bengalense* (H. & P. Sydow & Butler) Vánky, **comb. nov.**
Basionym: *Ustilago bengalensis* H. & P. Sydow & Butler, Ann. Mycol. 10:250, 1912. — *Sphacelotheca bengalensis* (H. & P. Sydow & Butler) Mundkur, 1939:108. — Type on *Cymbopogon pendulus* (Nees ex Steud.) Watson, India, Bengal, Duars, Banarhat, 8.IX.1908, I.H. Burkill, HCIO 1432. Isotypes in BPI 157972, 177259, 195064, HUV 17271!

Sori in the ovaries, probably also comprising other, inner floral organs, cylindrical, 0.5–1 x 3–10 mm, first covered by a brown peridium which ruptures irregularly disclosing the brown, powdery mass of spores and sterile cells surrounding a central, tapering columella. *Spores* when mature single, globose, subglobose to ellipsoidal, 10.5–13.5 x 11–15 µm, yellowish-brown; wall even, c. 0.5 µm thick, finely, densely punctate, spore profile smooth to finely serrulate, in SEM finely, densely echinulate. *Sterile cells* small, single, globose to subglobose, 5–8 µm in diameter, hyaline; wall 0.5–1 µm thick, smooth.

On *Cymbopogon pendulus* (Nees ex Steud.) Watson; S. Asia (India).



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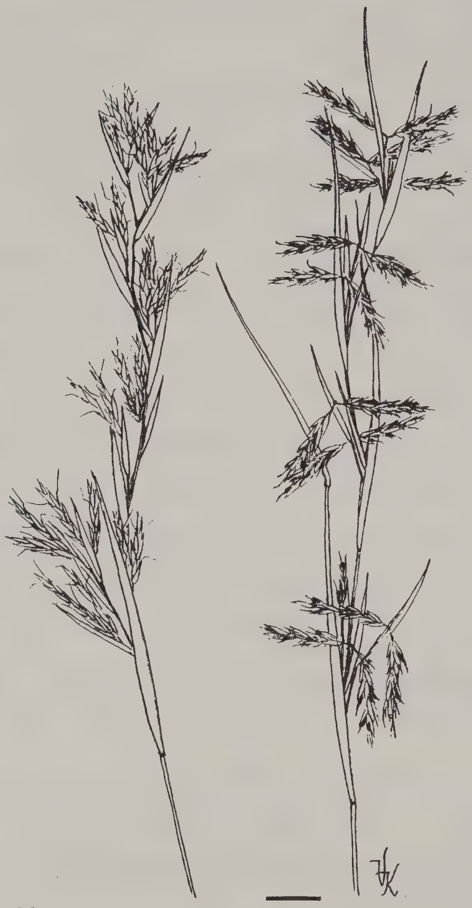

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Fig. 13. Sori of *Sporisorium compactum* Vánky, as long, narrow, horn-shaped bodies in the flowers of *Cymbopogon giganteus* Chiov. (type). Habit and enlarged two sori. Bars = 1 cm for habit, and 2 mm for the detail drawing.

Fig. 14. Sori of *Sporisorium cymbicum* Vánky in the ovaries of *Cymbopogon nardus* (L.) Renle (type). To the left a healthy inflorescence. Bar = 1 cm.

3. ***Sporisorium compactum*** **Vánky, sp. nov.**

Typus in matrice *Cymbopogon giganteus* Chiov., Senegal, Bakel, 14°54' N, 12°26' W, 3.I.1964, leg. G. Adam 19647, HUV 19818!

Sori ipsis speciei *Sporisorium barberi* similiter organa floralia intima in corporibus longis, corniformibus, agglomeratis, 0,5–1 x 5–15 mm transformantes, involucris floralibus proliferantibus partim occulti et peridio cinereobrunneo cooperti, quo longitudinaliter rupto massam nigram, semi-agglutinatam usque granuloso pulveream glomerulorum sporarum columellamque 1(–2) longam, filiformem ostendentes. *Glomeruli sporarum* globosi, ovoidei, ellipsoidales usque subpolyedrice irregulares, 40–80 x 50–120 µm, atrobrunnei usque opaci, e sporis multis, firmiter agglutinatis compositi. *Sporae* globosae, ellipsoidales usque parum irregulares, 9,5–13 x 12–15 µm; sporae externae atro-olivaceobrunneae; pariete 1–1,5 µm crasso, in superficie libera dense echinulato, imago obliqua sporae serrulata; sporae internae colore pallidiores; pariete tenui (cca. 0,5 µm), conspicue levi.

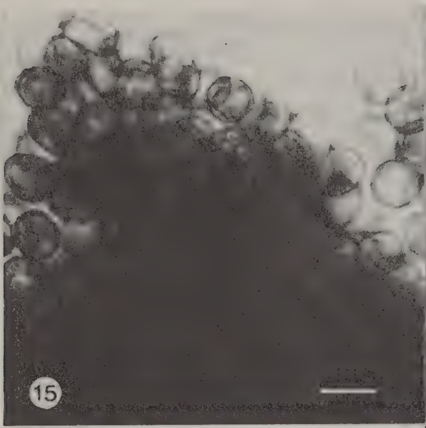
Sori (Fig. 13), similar to those of *Sporisorium barberi*, transforming the innermost floral organs into long, horn-shaped, agglomerated bodies, 0.5–1 x 5–15 mm, partly hidden by proliferating floral envelopes and covered by a greyish-brown peridium which ruptures longitudinally disclosing the black, semiagglutinated to granular-powdery mass of spore balls and 1(–2) long, filiform columellae. *Spore balls* (Figs. 17, 18) globose, ovoid, ellipsoidal to subpolyhedrally irregular, 40–80 x 50–120 µm, dark brown to opaque, composed of many, firmly agglutinated spores. *Spores* (Figs. 17, 18) globose, ellipsoidal to slightly irregular, 9.5–13 x 12–15 µm; outer spores dark olivaceous brown; wall 1–1.5 µm thick, densely echinulate on the free surface, spore profile serrulate; inner spores lighter coloured, thin-walled (c. 0.5 µm), apparently smooth.

On *Cymbopogon giganteus* Chiov.; W. Africa (Senegal).

The compact spore balls of firmly united spores, which break rather than separate under pressure, differentiate this species from all other smuts of *Cymbopogon*.

4. ***Sporisorium cymbicum*** **Vánky, sp. nov.**

Typus in matrice *Cymbopogon nardus* (L.) Rendle (det. S. Kativu), Zimbabwe, Manicaland Prov., Nyanga National Park, Mtarazi Waterfalls, 18°29'07" S, 32°47'36" E, alt. cca. 1700 m.s.m., 22.II.1999, leg. C. & K. Vánky, HUV 19808! Isotypi in BPI 841911, et in Vánky, Ust. exs. no. 1150. Paratypus in matrice *Cymbopogon validus* (Stapf) Stapf ex Burtt Davy, South Africa, Northern Prov., prope Duiwelskloof, Ebeneser Dam, road no. 528, 23°56'33" S, 29°57'12" E, alt. cca. 1490 m.s.m., 23.I.1997, leg. C. & K. Vánky, HUV 19816. Isoparatypi in BPI 841712, et in Vánky, Ust. exs. no. 1151. Paratypus in matrice *Cymbopogon plurinodis* (Stapf) Stapf ex Burtt Davy, South Africa, Western Cape Prov., 55 km E Knysna, Tsitsikamma National Park, 33°57'42" S, 23°32'00" E, alt. cca. 250 m.s.m., 19.XII.1996, leg. C. & K. Vánky, HUV 198871. Isoparatypi in Vánky, Ust. exs. no. 1156. Paratypus in matrice *Cymbopogon nardus* (det. M. Namaganda), Uganda, Iganga Distr., 50 km NNE Iganga, 00°48'35" N,



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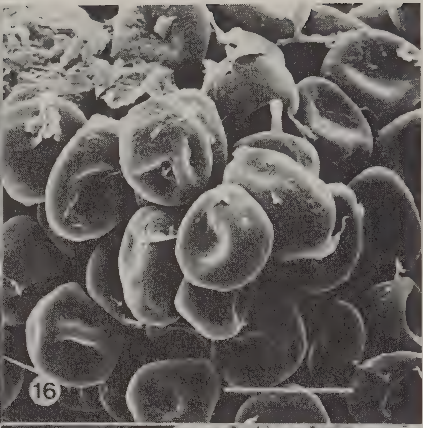

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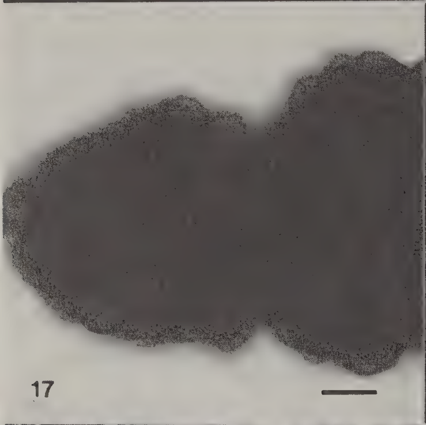

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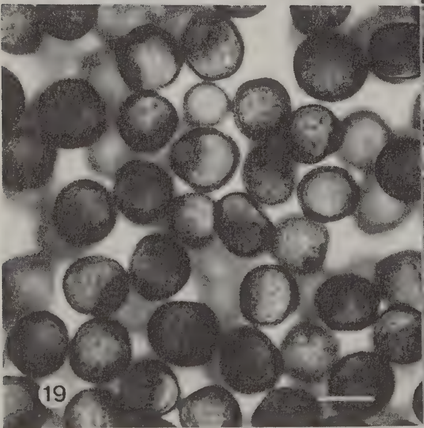

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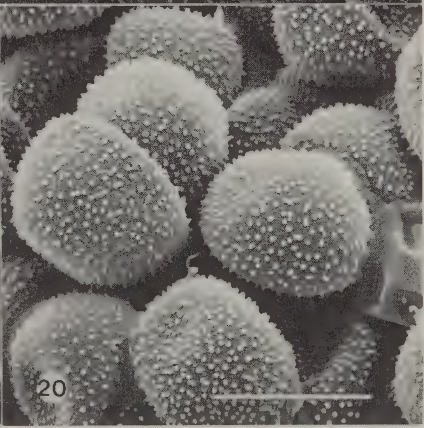

20

33°48'31" E, alt. cca. 1155 m.s.m., 1.III.2002, leg. M. Namaganda, C. & K. Vánky, HUV 19979! Isoparatypi in MHU, Kampala.

Sori in ovariis omnibus eiusdem inflorescentiae, ellipsoidales, 0,7–1 x 2–4 mm, indumentis floralibus plus-minus obtecti, primo peridio pallide brunneo cooperti, quo ab apice rupto massam sporarum atrobrunneam, pulveream, columellam centralem, flagelliformem, soros excedentem circumdantem demonstrantes. *Sporae* in maturitate singulares, globosae, subglobosae, ellipsoidales, raro parum irregulares, (9–)9,5–13 x (9,5–)10,5–13,5 µm, flavidobrunneae; pariete aequali, cca. 1 µm crasso, leniter, dense verrucoso-echinulato; imago obliqua sporae undulata usque leniter serrulata. *Cellulae steriles* paucae, in catervis irregularibus, cellulae singulares earum subglobosae, ellipsoidales usque irregulares, 11–17 µm longae, hyalinae vel subhyalinae; pariete cca. 1 µm crasso, levi.

Sori (Fig. 14) in the ovaries infecting all spikelets in an inflorescence, ellipsoidal, 0.7–1 x 2–4 mm, more or less hidden by the floral envelopes, first covered by a pale brown peridium which ruptures from its apex disclosing the dark brown, powdery mass of spores surrounding a flagelliform central columella exceeding the sori. *Spores* (Figs. 19, 20) when mature single, globose, subglobose, ellipsoidal, rarely slightly irregular, (9–)9.5–13 x (9.5–)10.5–13.5 µm, yellowish-brown; wall even, c. 1 µm thick, finely, densely verrucose-echinulate; spore profile wavy to finely serrulate. *Sterile cells* (Figs. 19, 20) few, in irregular groups, single cells subglobose, ellipsoidal to irregular, 11–17 µm long, hyaline or subhyaline; wall c. 1 µm thick, smooth.

On *Cymbopogon nardus* (L.) Rendle, *C. plurinodis* (Stapf) Stapf ex Burtt Davy, *C. validus* (Stapf) Stapf ex Burtt Davy (*C. afronardus* Stapf); Africa (South Africa, Uganda, Zimbabwe). According to Gibbs Russel et al., 1991:95, *C. validus* probably represents *C. nardus*.

Variations of ± 1 µm in the spore measurements of different collections may occur. The spores of the paratype from Uganda are somewhat smaller (9.5-13 µm long) and paler.

Sporisorium cymbicum is closest to *S. panamense* from which it differs especially by the smaller spores.

5. ***Sporisorium cymbopogonis*** (Mundkur) Vánky, **comb. nov.**

Basionym: *Tolyposporium cymbopogonis* Mundkur, Indian J. Agric. Sci. 14:51, 1944. — *Sorosporium cymbopogonis* (Mundkur) Thirumalachar & Neergaard,

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Figs. 15, 16. Spore balls and spores of *Sporisorium tothii* Vánky on *Pennisetum glaucum* (L.) R. Br., in LM and in SEM (type).

Figs. 17, 18. Spore balls and spores of *Sporisorium compactum* Vánky on *Cymbopogon giganteus* Chiov., in LM and in SEM (type).

Figs. 19, 20. Spores of *Sporisorium cymbicum* Vánky on *Cymbopogon nardus* (L.) Rendle, in LM and in SEM (type). Bars = 10 µm.

1977(1978):183. — Type on *Cymbopogon citratus* (DC.) Stapf, India, Mysore, Bangalore, 20.XII.1941, M.J. Thirumalachar, HCIO. Isotype in BPI 192617!

Tolyposporium christensenii Raghunath, 1968:120 (as "Ragunath"). — Type on *Cymbopogon flexuosus* (Nees ex Steud.) Watson, India, Kerala, near Aruvikkara, I.1965, T. Raghunath, AMH 264. Isotypes in HCIO 31248, HUV 5379!, 17274, 17275, IMI 137316.

Sori destroying the racemes, long cylindrical, 0.5–2 x 20–40 mm, more or less hidden by leaf sheaths and spathae, covered by a pale yellowish-brown peridium which dehisces from its apex disclosing the black, granular-powdery mass of spore balls and 1–2(–3), long, filiform columellae. Usually all racemes of an inflorescence are infected, denoting a systemic infection. Infected inflorescence more or less congested. Raghunath (1970) also observed local infection with formation of witches' brooms. *Spore balls* persistent, variable in shape and size, subglobose, ellipsoidal, elongated or irregular, 30–85 x 40–100 µm, dark reddish-brown, composed of tens of spores which separate by pressure. *Spores* dimorphic, outer spores subglobose, ovoid, ellipsoidal to usually subpolyhedrally slightly irregular, from 6.5–9 x 7–11 µm to 8.5–13 x 9–13 µm, reddish-brown; wall uneven, 1–2 µm thick, free surface moderately densely verrucose-echinulate, contact sides punctate or apparently smooth, spore profile of the free surface serrulate; inner spores rounded, subpolyhedrally slightly irregular, about the size of the outer spores, pale yellowish-brown; wall even, c. 0.5 µm thick, apparently smooth. *Sterile cells* absent.

On *Cymbopogon citratus* (DC.) Stapf, *C. coloratus* Stapf, *C. flexuosus* (Nees ex Steud.) Watson; S. Asia (India), Indonesia (Bali).

I am considering *S. cymbopogonis* in a broad sense, with rather big variations in the spore measurements. These in the type of *S. cymbopogonis* are 6.5–9 x 7–11 µm, in *T. christensenii* 8.5–13 x 9–13 µm, and in a specimen on *C. flexuosus* collected in Bali (HUV 19910) 7–10.5 x 8–11 µm. Other characters are identical in all collections I have seen.

6. ***Sporisorium cymbopogonis-distantis*** (L. Ling) L. Guo, 1998:1.

Sorosporium cymbopogonis-distantis L. Ling, 1953b:341. — Type on *Cymbopogon distans* (Nees ex Steud.) Watson, China, Szechwan Prov., vicinity of Chengtu, XI.1947, K.R. Lin, BPI 195143!

Sori in the ovaries (0.5–1 x 1–2 mm) or in the whole raceme (10–17 mm long), concealed by the spathae, first covered by a brown, thick peridium which ruptures disclosing the semiagglutinated to granular-powdery mass of spore balls surrounding several filiform columellae. *Spore balls* globose, ovoid, ellipsoidal to irregular, 40–90 x 60–120 µm, dark reddish-brown to opaque, composed of numerous spores which separate by pressure. *Spores* subglobose, ellipsoidal to subpolyhedrally irregular, 10.5–13.5 x 12–17(–19) µm, yellowish- to reddish-brown; wall even to slightly uneven, c. 1 µm thick, outer spores apparently smooth to finely punctate-verruculose, inner spores smooth to finely punctate.

On *Cymbopogon distans* (Nees ex Steud.) Watson; E. Asia (China).

7. *Sporisorium densiflorum* (L. Ling) Vánky, comb. nov.

Basionym: *Sorosporium densiflorum* L. Ling, Lloydia 16:188, 1953a. — Type on *Cymbopogon densiflorus* (Steud.) Stapf, Belgian Congo [= Democratic Rep. of Congo], Leverville, 6.XII.1918, H. Vanderyst, BR 1329. Isotype in BPI 179970!

Sori comprising the racemes, narrow-cylindrical, 0.5–1 x 15–20 mm, completely hidden by leaf sheaths and spathae, first covered by a thin peridium which ruptures from its apex disclosing the dark brown, semiagglutinated to powdery mass of spore balls, spores and 2–7 long, filiform columellae. *Spore balls* subglobose, ovoid, oblong or irregular, 40–100 x 50–140 µm, dark reddish-brown to opaque, composed of numerous, easily separating spores. *Spores* subglobose, ovoid, ellipsoidal, mostly subpolyhedrally irregular, 9–13 x 9.5–14(–15) µm, reddish-brown; wall unevenly thick, 0.5–2 µm, finely, rather densely punctate-verruculose, spore profile smooth. *Sterile cells* not seen.

On *Cymbopogon densiflorus* (Steud.) Stapf, and *C. dieterlenii* Stapf ex Phill.; C. & S. Africa (Congo, South Africa).

8. *Sporisorium lanigeri* (Magnus) Vánky, comb. nov.

Basionym: *Ustilago lanigeri* Magnus, Verh. K. K. Zool.-Bot. Ges. Wien 49:88, 1899. — *Sphacelotheca lanigeri* (Magnus) Maire, in Zundel, 1930:141. — Type on *Andropogon laniger* Desf. (= *Cymbopogon schoenanthus* (L.) Spreng.), Iran, Kerman, Mt. Kuh-tagh-Ali, alt. 2200 m, 20.VI.1892, J. Bornmüller 4436, S. Isotypes in BPI 194475! and HBG.

Ustilago furcata Patouillard & Hariot, 1900:236. — *Sphacelotheca furcata* (Pat. & Har.) Pat. & Har., in Hariot & Patouillard, 1909:197. — Type on *Cymbopogon* sp., French Sudan, Reg. Tombuctou, Sompi, VIII.1899, M.A. Chevalier, FH. (syn. by Ling, 1951a:42).

Ustilago schoenanthi H. & P. Sydow & Butler, 1906:425. — *Sphacelotheca schoenanthi* (H. & P. Sydow & Butler) Zundel, 1930:136. — Type on *Andropogon schoenanthus* L. (= *Cymbopogon schoenanthus* (L.) Spreng.), India, Madras, Tinnevelli, Alancolam, 1.VII.1901, C.A. Barber, HCIO 449. Isotypes in BPI 166233, 188944, 193952, HUV 1994, 17304! (syn. here).

Sphacelotheca moggii Zundel, 1930:130. — Type on *Andropogon plurinodis* Stapf (= *Cymbopogon plurinodis* (Stapf) Stapf ex Burtt Davy), South Africa, British Bechuanaland, Armoedsvlakte, 28.VIII.1924, A.O.D. Mogg, PREM 19859. Isotypes in BPI 178080, 195089, HUV 18171! (syn. here).

Sphacelotheca concentrica Zundel, 1930:138. — Type on *Cymbopogon plurinodis* (Stapf) Stapf ex Burtt Davy, South Africa, Transvaal, Pretoria, Kaalplaats, 1.XI.1917, A.O.D. Mogg, PREM 10708. Isotypes in BPI 195116, HUV 18020! (syn. by Ling, 1951a:43, confirmed).

Sorosporium pretoriense Zundel (as "*pretoriaense*"), 1930:146. — Type on *Andropogon dichrous* Steud. (= *Cymbopogon plurinodis*; comp. Zundel, 1953:70), South Africa, Transvaal, Pretoria, between Ashbury and Irene, 14.III.1917, I.B. Pole-Evans, PREM 10045. Isotypes in BPI 180139, HCIO 10143, HUV 15413! (syn. here).

Sphacelotheca natalensis Zundel, 1930:139. — Type on *Andropogon* sp. (= *Cymbopogon excavatus* (Hochst.) Stapf ex Burtt Davy; comp. Doidge, 1950:382), South Africa, Natal, Mooi River, 4.IX.1917, A.O.D. Mogg, PREM 11705. Isotypes in BPI 190145, 195074, 195090, HUV 18173! (syn. here).

Sphacelotheca columellifera "(Tul.) Yen", 1937:76 (not (L.-R. & C. Tul.) Ciferri, 1928:32). — *Sphacelotheca yenii* Zundel, 1939a:584. — Type on *Andropogon laniger* Desf. (= *Cymbopogon schoenanthus* (L.) Spreng.), Morocco, near Skourat, 13.VI.1934, G.J.L. Malençon, PC. Isotypes in HMAS, HUV 12075! (syn. by Ling, 1951a:43, confirmed).

Sphacelotheca cymbopogonis W.Y. Yen, 1938:7. — Type on *Cymbopogon proximus* Stapf, Chad, Quadaï, between Bittine and Abéché, 10.X.1935, M. Murat 34, LAM. (syn. by Ling, 1951a:43).

Sphacelotheca consueta H. Sydow, in Sydow & Ahmad, 1939:442. — Type on *Cymbopogon parkeri* Stapf, Pakistan, Panjab, Shahkot Hills, 15.XII.1935, S. Ahmad 60, HCIO 10101. Isotypes in BPI 195065, S, HUV 16374, topotype in BPI 1110460. (syn. by Ling, 1951a:43, confirmed).

Sorosporium ladharense H. Sydow, in Sydow & Ahmad, 1939:443. — Type on *Cymbopogon jwarancusa* (Jones) Schult., India, Punjab, Ladhar, Sheikhupura, 10.IV.1937, S. Ahmad 60a, HCIO 10104. Isotypes in BPI 195124, HUV 15618! (syn. here).

Sphacelotheca cymbopogonis-colorati Mundkur & Thirum., in Thirumalachar & Mundkur, 1951:3. — *Sporisorium cymbopogonis-colorati* (Mundkur & Thirum.) Kakishima & Ono, 1993:189. — Type on *Cymbopogon coloratus* (Nees) Stapf, India, Mysore, Hassan, Bellur, 28.XII.1942, M.J. Thirumalachar, HCIO 10698. Isotypes in HUV 17280!, IMI 4954. (syn. here).

Sphacelotheca mutila Mundkur & Thirum., in Thirumalachar & Mundkur, 1951:4. — Type on *Cymbopogon caesius* (Nees) Stapf, India, Mysore, Bangalore, 18.VIII.1944, M.J. Thirumalachar, HCIO 10774: isotype in HUV 17292! (syn. here).

Sori destroying the racemes, more or less hidden by the enveloping spathae, cylindrical, tapering at the apex, 1–2 x 5–16 mm, first covered by a pale brown, thick peridium which ruptures irregularly disclosing the dark brown, semiagglutinated to powdery mass of spore balls, spores and sterile cells surrounding a stout, tapering, rarely flagelliform, sometimes bifurcate, central columella. *Spore balls* globose, ellipsoidal to irregular, 30–120 x 40–140 µm, dark reddish-brown to opaque, composed of numerous spores which separate by pressure. *Spores* globose, subglobose, ellipsoidal to slightly irregular, often slightly compressed, 5.5–8 x 6–9 µm, yellowish- to reddish-brown; wall evenly thick, 0.5–1 µm, apparently smooth to finely, moderately densely verruculose-echinulate; spore profile smooth to finely wavy. *Sterile cells* in irregular groups, single cells subglobose, ellipsoidal to irregular, 7–20 µm long, hyaline to pale yellowish-brown tinted; wall 1–1.5 µm thick, smooth.

On *Cymbopogon ambiguus* A. Camus, *C. bombycinus* (R. Br.) Domin, *C. caesius* (Nees) Stapf, *C. coloratus* (Nees) Stapf, *C. commutatus* (Steud.) Stapf, *C. distans* (Nees ex Steud.) Watson, *C. elegans* Spreng., *C. excavatus* (Hochst.)

Stapf ex Burtt Davy, *C. flexuosus* (Nees ex Steud.) Watson, *C. jwarancusa* (Jones) Schult., *C. marginatus* (Steud.) Stapf ex Burtt Davy, *C. nardus* (L.) Rendle, and its var. *confertiflorus* (Steud.) Stapf ex Bor (*C. confertiflorus* (Steud.) Stapf), *C. obtectus* S.T. Blake, *C. parkeri* Stapf, *C. plurinodis* (Stapf) Stapf ex Burtt Davy, *C. procerus* (R. Br.) Domin (*C. exaltatus* (R. Br.) Domin), *C. proximus* Stapf, *C. refractus* (R. Br.) A. Camus, *C. schoenanthus* (L.) Spreng. (*Andropogon schoenanthus* L., *Andropogon laniger* Desf.), *C. validus* (Stapf) Stapf ex Burtt Davy; Africa (Chad, Morocco, South Africa, Sudan, Zimbabwe), Asia (India, Iran, Iraq, Pakistan), Australia.

Study of the types of ***Ustilago lanigeri*** Magnus, ***Ustilago schoenanthi*** H. & P. Sydow & Butler, ***Sphacelotheca moggii*** Zundel, ***Sorosporium pretoriense*** Zundel, ***Sphacelotheca natalensis*** Zundel, ***Sorosporium ladharense*** H. Sydow, ***Sphacelotheca cymbopogonis-colorati*** Mundkur & Thirum. and ***Sphacelotheca mutila*** Mundkur & Thirum. revealed only insignificant differences in the colour, size and ornamentation of the spores, hence they are considered to be synonyms.

9. *Sporisorium mildbraedii* (H. & P. Sydow) Vánky, **comb. nov.**

Basionym: *Ustilago mildbraedii* H. & P. Sydow, in Mildbraed, Wissenschaftliche Ergebnisse der Deutschen Zentral-Afrika-Expedition 1907-1908, Bd. 2, p. 95, 1914. — *Sphacelotheca mildbraedii* (H. & P. Sydow) Zundel, 1930:135. — Type on *Andropogon schoenanthus* L. (= *Cymbopogon schoenanthus* (L.) Spreng.), Deutsch Ost Africa [= Rwanda], Mpororo, at Kakitumbe Creek, 23.VII.1907, G.W.J. Mildbraed 357, S. Isotypes in BPI 163317!, 194453!

Sphacelotheca cymbopogonis-afronardi L. Ling, nom. herb. — On *Cymbopogon afronardus* Stapf (= *C. nardus* (L.) Redle), Uganda, Kawanda, VII.1940, leg. C.G. Hansford 2754, BPI 177450, 177451, Herb. Mycol. Dep. Agric. Uganda 2754, HUV 1958, 6066, IMI 10956.

Sori destroying the racemes, concealed by the spathae, 1–2 x 10–15 mm, peridium lacking. Spore mass brown, powdery, surrounding a well-developed central columella with short lateral branches. *Spore balls* subglobose, ellipsoidal, irregular, 40–80 x 40–120 µm, dark reddish-brown to subopaque, composed of numerous, easily separating spores. *Spores* globose, subglobose, ovoid to ellipsoidal, 5–6.5 x 5.5–7 µm, yellowish-brown; wall even, c. 0.5 µm thick, finely, moderately densely punctate to verrucose-echinulate; spore profile smooth, wavy to sparsely serrulate. *Sterile cells* in irregular groups, single cells globose, ellipsoidal to irregular, 7–12 µm long, subhyaline to pale yellowish-brown, wall c. 0.5 µm thick, smooth.

On *Cymbopogon schoenanthus* (L.) Spreng. (*Andropogon schoenanthus* L.), *C. nardus* (L.) Redle (*C. afronardus* Stapf); E. Africa (Tanzania, Uganda).

Sporisorium mildbraedii differs from *S. lanigeri* especially in the lack of a peridium and in the smaller, more conspicuously ornamented spores.

10. *Sporisorium mutabile* (H. Sydow) Vánky, **comb. nov.**

Basionym: *Sphacelotheca mutabilis* H. Sydow, Ann. Mycol. 35:24, 1937. — *Sorosporium mutabile* (H. Sydow) L. Ling, 1951b:107. — Type on *Cymbopogon* *refractus* (R. Br.) A. Camus, Australia, New South Wales, Pennant Hills, VI.1931, L.R. Fraser 118. Isotypes in BPI 195071, HUV 18115!, IMI 37633.

Sorosporium cantonense Zundel, 1939a:584 (as "*Cantonensis*"). — *Sporisorium cantonense* (Zundel) L. Guo, 1998:1. — Type on *Cymbopogon hamatulus* (Nees) A. Camus (as "*hematatus*"), China, 80 miles north of Canton, on North River, Yinktak (Guangdong, Guangzhou), 9.IX.1921, A.S. Hitchcock 18822, BPI 179478! (syn. here).

Sorosporium terrareginalense Zundel, 1944:409. — Type on *Cymbopogon refractus* (R. Br.) A. Camus, Australia, Queensland, Brisbane, Highway near Mt. Coot-tha, 9.II.1943, M.S. Clemens, BPI 180159! (syn. by Ling, 1951b:107).

Sori destroying the racemes, long cylindrical, 0.5–1 x 5–13 mm, partly hidden by leaf sheaths and spathae, first covered by a brown peridium which ruptures from its apex disclosing the dark brown, semiagglutinated to granular powdery mass of spore balls and 1–3 long, filiform columellae. *Spore balls* globose, ellipsoidal, irregular, 40–80 x 40–120 µm, dark reddish-brown to subopaque, composed of numerous, easily separating spores. *Spores* subpolyhedrally irregular to elongated, 10–15 x 13–18(–20) µm, yellowish-brown; wall unevenly thick, 0.5–1.5(–2) µm, evidently, rather densely verrucose, especially on the free surface, inner spores punctate-verruculose; spore profile smooth to wavy or finely serrulate.

On *Cymbopogon bombycinus* (R. Br.) Domin, *C. coloratus* (Nees) Stapf, *C. densiflorus* (Steud.) Stapf, *C. distans* (Nees ex Steud.) Watson, *C. hamatulus* (Nees) A. Camus, *C. nardus* (L.) Rendle, *C. refractus* (R. Br.) A. Camus; Africa (Malawi, Zimbabwe), Asia (China, India, Pakistan), Australia.

Comparison of the types revealed that ***Sporisorium cantonense*** is identical with and a synonym of *Sporisorium mutabile*.

11. ***Sporisorium nardi*** (H. & P. Sydow) Vánky, **comb. nov.**

Basionym: *Ustilago nardi* H. & P. Sydow, in H. & P. Sydow & Butler, Ann. Mycol. 4:425, 1906. — *Sphacelotheca nardi* (H. & P. Sydow) Zundel, 1930:137. — *Sorosporium nardi* (H. & P. Sydow) L. Ling, 1951a:47. — Type on *Andropogon nardus* L. (= *Cymbopogon nardus* (L.) Rendle), India, Malabar, Wyanaad Hills, Vayitri, 2.XI.1904, E.J. Butler, HCIO 470. Isotypes in BPI 163727–173730, HUV 1977, 17293, S.

Sori in the racemes, filiform, c. 0.5 x 5–10 mm, completely hidden by the spathae, covered by a brown peridium which ruptures disclosing the dark brown, semiagglutinated to granular-powdery mass of spore balls and 1–2 long, filiform columellae usually protruding beyond the sori. *Spore balls* globose, ellipsoidal to irregular, 30–70 x 30–120 µm, dark reddish-brown to subopaque, composed of many, easily separating spores. *Spores* subglobose, ellipsoidal to slightly irregular, 5.5–8 x 6–9.5 µm, yellowish-brown; wall even, c. 0.5 µm, apparently smooth to finely punctate-verruculose, spore profile smooth, in SEM finely, moderately densely verruculose.

On *Cymbopogon nardus* (L.) Rendle (*Andropogon nardus* L.); S. Asia (India).

12. ***Sporisorium panamense*** (Zundel & Dunlap) M. Piepenbr., in BPI (2001). *Sphacelotheca panamensis* Zundel & Dunlap, in Zundel, 1939b:995. — Type on *Cymbopogon* sp. (= *C. citratus* (DC.) Stapf), Panama, Cherique Prov., near El Bogrete, IX.-X.1911, A.S. Hitchcock, BPI 190260!

Sori in the ovaries, c. 0.5–1 x 3–4 mm, hidden by the floral envelopes, first covered by a thin, brown peridium which ruptures disclosing the dark brown, semiagglutinated to powdery mass of spores, sterile cells and a narrowing central columella. *Spores* when mature single, subglobose to ellipsoidal, 12–15 x 13–17.5 µm, yellowish-brown; wall even, c. 1 µm thick, finely, densely punctate-verruculose, spore profile smooth, wavy to finely serrulate. *Sterile cells* in irregular groups, single cells ellipsoidal to irregular, 12–16 µm long, hyaline; wall c. 1 µm thick, smooth.

On *Cymbopogon citratus* (DC.) Stapf); C. America (Panama).

13. ***Sporisorium spermoideum*** (Berk. & Broome) Vánky, **comb. nov.** Basionym: *Ustilago spermoidea* Berkeley & Broome, J. Linn. Soc., Bot. 14:94, 1875. — *Sphacelotheca spermoidea* (Berk. & Broome) Mundkur, 1939:96. — *Sorosporium spermoideum* (Berk. & Broome) L. Ling, 1951a:48. — *Sorosporium spermoideum* (Berk. & Broome) Zundel, 1953:74 (superfl. comb., not Ling, 1951a). — Type on *Cymbopogon martinii* (Roxb.) Watson (as "*martii*"), Ceylon [= Sri Lanka], Dolosbagey, V.1868, Thwaites 589, BM. Isotype in BPI 166549!

Sori destroying the racemes, long cylindrical, 0.5–1 x 5–15 mm, hidden by leaf sheaths and spathae, first covered by a pale brown peridium which ruptures irregularly disclosing the blackish-brown, semiagglutinated to granular powdery mass of spore balls and 1–5 long, filiform columellae. *Spore balls* ovoid, oblong, usually irregular, 50–140 x 60–210 µm, opaque, composed of many spores which separate by pressure. *Spores* subglobose, ellipsoidal to subpolyhedrally slightly irregular, (7–)8–10.5 x 9–11(–12.5) µm, yellowish-brown, paler on one side; wall unevenly thick, thinner on the pale side, 0.5–1 µm, apparently smooth to finely, densely punctate-verruculose, spore profile smooth.

On *Cymbopogon confertiflorus* (Steud.) Stapf, *C. martinii* (Roxb.) Watson, *C. nardus* (L.) Rendle, ?*Capillipedium venustum* (Thw.) Bor (*Andropogon venustus* Thw.); S. Asia (Sri Lanka).

Zundel, 1930:142, described ***Sphacelotheca zilligii*** Zundel, on *Andropogon* sp., South Africa, Cape Province, Vryburg, 25.III.1921, A.O.D. Mogg, PREM 20666. Isotypes in BPI 192099, 195088, HUV 18128! Doidge, 1950:384, and also Zundel, 1953:115, considered the host plant to be a *Cymbopogon* sp. Unfortunately, no healthy host plant is preserved. Judged from the sori, I doubt that the host is a *Cymbopogon*.

Recently, Bag and Agarwal (2001:221) published a new species, ***Sporisorium martinii*** Bag & Agarwal (as "*martinae*"), type on *Cymbopogon martinii* (Roxb.) Watson, India, West Bengal, Coochbehar, III.1996, D.K. Agarwal, HCIO 42945. Unfortunately, study of the type specimen was not possible. The incomplete description of this species, reproduced below, does not permit its comparison with other smut fungi of *Cymbopogon*, or its inclusion into the following key.

"*Sori* produced in the ovaries, only in parts of spikelets between the spreading glumes which occasionally exceed in length, enclosed by peridium that soon ruptures and dehisces releasing dark brown to black dusty spore mass. Spores loosely adhere to one another forming loose balls. *Sterile cells* globose to subglobose, hyaline, similar or mostly larger than spores, 5.1–11.1 µm. *Spores* light orange yellow (Ridgeway Plate III, d-3), globose to subglobose, spherical, 5.1–7.7 µm (Avg. 6.6 µm) in size. SEM showed echinulate sporewall."

Key to the smut fungi of *Cymbopogon*

(*S.* = *Sporisorium*)

1. Sori horn-shaped, forming witches' brooms in the inflorescence 2
– Sori not so 3
2. Spore balls easily disintegrating. Spores tuberculate .... ***S. barberi***
– Spore balls compact, permanent. Outer spores echinulate .... ***S. compactum***
3. Spores (12–)13–17(–20) µm long 4
– Spores smaller 6
4. Columella one, simple. Sterile cells present. .... ***S. panamense***
– Columella 1–several, filiform. Sterile cells absent 5
5. Spore wall c. 1 µm thick. Outer spores apparently smooth to finely punctate-verruculose .... ***S. cymbopogonis-distanti***
– Spore wall 0.5–1.5(–2) µm thick. Outer spores verrucose .... ***S. mutabile***
6(3). Spores between 10–15 µm long 7
– Spores smaller 9
7. Sterile cells small, 5–8 µm .... ***S. bengalense***
– Sterile cells 11–17 µm or absent 8
8. Sori in the ovaries, ellipsoidal, 2–4 mm long. Columella 1, flagelliform. Sterile cells present .... ***S. cymbicum***
– Sori in the racemes, 15–20 mm long. Columellae 2–7, filiform. Sterile cells absent .... ***S. densiflorum***
9(6). Spores 9–11(–12.5) µm long, lighter on one side .... ***S. spermoideum***
– Spores smaller, not lighter on one side 10
10. Columella one, stout, rarely flagelliform. Sterile cells present 11
– Columella 1–several, filiform. Sterile cells absent 12
11. Columella with short branches. Peridium absent. Sterile cells 7–12 µm long. Spores 5.5–7 µm long .... ***S. mildbraedii***
– Columella simple or bifurcate. Peridium present. Sterile cells 10–20 µm long. Spores 6–9 µm long .... ***S. lanigeri***
12(10). Spores 7–13 µm long, free surface verrucose-echinulate. ***S. cymbopogonis***
– Spores 6–9.5 µm long, free surface finely punctate-verruculose .... ***S. nardi***

ABOUT SOME OF SPEGAZZINI'S SMUT FUNGI

Marie L. Farr (1973) enumerated Spegazzini's fungal taxa and, based on publications by different authors, also all taxonomic and nomenclatural changes since their publication. Study of many of Spegazzini's original specimens, preserved in LPS (La Plata, Argentina), and in other herbaria, resulted in some additional changes.

New name

Sporisorium spegazzinii Vánky, nom. nov.

Replacing *Sorosporium argentinum* Spegazzini, Anales Soc. Ci. Argent. 12:65, 1881 (not *Sporisorium argentinum* (Hirschh.) Vánky, opus praesens). — *Ustilago argentina* (Speg.) Spegazzini, 1925:151. — Type on "*Tricholaena insularis*" (= misnamed *Panicum urvilleanum* Kunth; comp. Spegazzini, 1925:151), Argentina, Prov. Rioja, near Vinchina, leg. G. Hieronymus.

Ustilago negeriana Dietel, 1898:(147). — Type on *Panicum urvilleanum* Kunth, Chile, Prov. Concepción, near Yumbel, coll. F. Neger, BPI 179441. (syn. by Spegazzini, 1925:151).

Sori in the flowers, infecting all in a panicle, inconspicuous, destroying the inner floral organs, protected by the outermost floral envelopes, 1.5–2 x 2–2.5 mm, first covered by a yellowish-brown peridium which ruptures at maturity from its distal part disclosing the semiagglutinated to powdery, dark brown mass of spore balls and spores surrounding three, short, simple or distally bifurcate columellae. *Spore balls* subglobose, ellipsoidal to slightly irregular, 35–90 x 45–130 µm, dark reddish-brown, composed of tens to hundreds of easily separating spores. *Spores* subpolyhedrally irregular, more rarely subglobose or ellipsoidal, yellowish-brown, 8–10.5 x 9–12(–13) µm; wall in LM c. 0.5 µm thick, in some places thinner (which is difficult to see), surface smooth to very finely and inconspicuously punctate; in SEM the spores have several (6–8?), often mamillate depressions, surface very finely, densely verruculose. *Sterile cells* not seen.

On Gramineae: *Panicum urvilleanum* Kunth; S. America (Argentina, Chile).

Synonyms

Ustilago cordobensis is *U. syntherismae*

Spegazzini (1881:64) described *Ustilago cordobensis* Speg. — *Sphacelotheca cordobensis* (Speg.) H.S. Jackson, 1930:298. — *Sphacelotheca cordobensis* (Speg.) Ciferri, 1931:16 (comb. superfl.). — *Sporisorium cordobense* (Speg.) Vánky, 2000:208. — Type on "*Panicum jaboncillum*" Hieron., nom. nud. (= *Panicum leucophaeum* H.B.K., = *Trichachne insularis* (L.) Nees, = *Digitaria insularis* (L.) Fedde; comp. Spegazzini, 1909:288), Argentina, near Cordoba, coll. G.H.E.W. Hieronymus. (syn. here).

Ustilago cacheutensis Spegazzini, 1909:293. — Type on *Panicum leucophaeum* H.B.K. (= *Digitaria insularis* (L.) Fedde), Argentina, near Mendoza, Cacheuta, I.1909, C. Spegazzini. (syn. by Spegazzini, 1925:153).

Study of several Argentinean collections of *Ustilago cordobensis* on *Digitaria californica* (HUV 19192), *D. insularis* (LPS 3010), "*Panicum penicilligerum*" (LPS 3011), "*Trichachne rigida*" (LPS 12361) could not reveal any essential difference between ***Ustilago cordobensis*** and the earlier published *Caeoma* (*Uredo*) *syntherismae* Schweinitz, 1834:290 (= *Ustilago syntherismae* (Schwein.) Peck, 1875:103, type on *Syntherisma* sp. (= *Digitaria* sp.), USA), hence they are considered synonyms.

The sori of *Ustilago cordobensis* and *Sporisorium panici-leucophaei* are similar, destroying the whole inflorescence. They are surrounded by a thin peridium which flakes away disclosing the dark brown spore masses and several filiform columellae. Probably this is the reason for the confusion between these two smuts. Zundel, 1953:86 & 104, based on spore measurements, demonstrated that *S. cordobense* and *S. panici-leucophaei* are two different species.

Ustilago syntherismae is one of the intermediate species between *Ustilago* and *Sporisorium* having some characters of both of these genera. Molecular data may be helpful for a more correct generic placement.

Entyloma phalaridis is *Jamesdicksonia dactylidis* s. lat.

Spegazzini described *Entyloma phalaridis* Spegazzini, 1912:21 (n. v.), type on *Phalaris intermedia* Bosc ex Poir., La Plata, X.1919, C. Spegazzini, LPS 3362!, Later, Spegazzini, 1925:155, considered it to be *Ustilago striiformis* (West.) Niessl. This could not be confirmed by study of the type specimen, which contain spores of *E. dactylidis* (Pass.) Cif., s. lat. (= *Jamesdicksonia dactylidis* (Pass.) R. Bauer, Begerow, Nagler & Oberw.), type on *Dactylis glomerata* L.

Ustilago abortifera is *Sporisorium reilianum*

Ustilago abortifera Spegazzini, 1899:208, type on *Zea mays* L., Argentina, Salta, VIII.1881, LPS 3195! is *Sporisorium reilianum* (Kühn) Langdon & Full., as shown by Ciferri, 1938:403 (as *Sphacelotheca holci-sorghi* (Riv.) Cif.), and by Hirschhorn, 1941:350, and others (as *Sorosporium* or *Sphacelotheca reiliana*); comp. Farr, 1973:1582. (synonymy confirmed).

Ustilago sorghicola is *Sporisorium sorghi*

Ustilago sorghicola Spegazzini, 1902:58, type on *Sorghum vulgare* Pers. (*Sorghum bicolor* (L.) Moench), Argentina, La Plata, III.1902, C. Spegazzini, LPS 3047! is *Sporisorium sorghi* Ehrenberg ex Link., as demonstrated by Ling, 1953b:333 (as *Sphacelotheca sorghi* (Link) Clinton). (synonymy confirmed).

Excluded species

Entyloma nectrioides is a Plasmodiophoromycota

Spegazzini, 1891:171, described ***Entyloma nectrioides*** Speg. (as "*nectrioide*"), type "Ad folia Leguminosae? arboreae cujusdam in montanis inter Peribebuy et Mbatobi, Jun. 1883 (sub n. 3783)", Paraguay, Mt. Cordillera de Peribebuy, between Peribebuy and Mbatoby, VI.1883, B. Balansa 3783. Isotypes in Balansa, Pl. du Paraguay 1878-1884, no. 3783, PC, HUV 15939!

According to the original description, the fungus produces amphigenous, rounded, somewhat swollen, reddish-brown leaf spots, a few mm in diameter. *Spores* globose, ovoid or ellipsoidal, densely packed, often subangular or sinuous due to mutual pressure, large (50 x 50–80 µm in diameter); wall very thick (10 µm), hyaline, multilayered, with densely situated, concentric striae; endoplasm coarsely, densely granular-guttulate, orange-yellow.

Study of this fungus was possible through the kindness of the late Professor Ch. Zambettakis (Paris) who gave me a small fragment of the isotype, preserved in PC as "B. Balansa, Pl. du Paraguay 1878-1884. No. 3783. *Entyloma nectrioide* Speg. (n. sp.). Paraguay, Cordillère de Péribebuy, au-dessus de Mbatoby, VI.1883".

Spores of 50-80 µm diameter, with hyaline, smooth, 4–10 µm thick, multilayered wall, which collapses when the "spores" are emptied, certainly do not belong to a smut fungus. It turned out also that the content of these "spores" is composed of tightly packed, ovoid or ellipsoidal, small, hyaline cells measuring c. 1 x 1.5 µm. These are probably developing zoospores of a Plasmodiophoromycota, and the giant "spores" the sporangia.

Entyloma ameghinoi is a *Physoderma* sp.

Spegazzini, 1902:57, published ***Entyloma ameghinoi*** Speg., type on *Ranunculus cymbalaria* Pursh, Argentina, Patagonia, in the marshes of Chonkenk-aik, along Rio Chico, autumn 1899, C. Ameghino, LPS 3355!

Sori on the leaves and petioles as minute, pale, not or barely swollen spots. *Spores* globose or ellipsoidal, 15–27 x 16–34 µm, pale yellowish-brown; wall c. 1 µm thick, smooth.

Study of the type specimen revealed large spores, typical for a *Physoderma* sp., not for an *Entyloma*.

Ciferri, 1963:338, considered *E. ameghinoi* to be a synonym of "*Tuburcinia ranunculi-gouani* (DC.) Liro", a name which was never published by Liro.

Ustilago dubiosa is insect work

Spegazzini, 1881:64, described ***Ustilago dubiosa*** Speg. — Type on *Conyza graminifolia* Spreng. (= *Aster divaricatus* Nutt.), Argentina "in herbosis campestribus secus el Rio de la Plata, Recoleta", VI.1881, C. Spegazzini, LPS 3208!. Spegazzini, 1881:65, remarked: "Species valde dubia, corolla bulloso-inflatam, ... ; cavum internum a larva dipteri speciei cujusdem semper habitatum!". No spores of a smut fungus could be detected in the scanty type specimen, only insect galls. It is certainly not a smut fungus. For its description see Spegazzini (l.c.) and Zundel, 1953:157, who considered it a doubtful smut.

Ustilago lycoperdospora is a *Ustilaginoidea*

Spegazzini, 1884a:88, described ***Ustilago lycoperdospora*** Speg. from immature panicles of *Vilfa* sp., with the remarks "Species perquam dubiosa". Zundel, 1953, does not mention it. Study of the type (LPS 16382, also under the name of *Ustilago peridermiospora* Speg.) showed that it is a *Ustilaginoidea*.

Lectotypes proposed

Spegazzini, 1925:147, described ***Entyloma chilense*** Speg. — Type on *Conyza chilensis* Spreng., La Plata and Buenos Aires, 1919-1923. No type was indicated by Spegazzini. I am designating as a lectotype the specimen of Buenos Aires, 1.X.1919, LPS 3359!

For its description see Spegazzini (op. cit.), and Zundel, 1953:242.

Spegazzini, 1909:291, described ***Tilletia eremophila*** Speg. — Type "Ad spiculas *Sporoboli asperifolii* vulgatissima circa Mendoza, Aest. 1902–1908", without indicating a type. In LPS there are two collections: LPS 3675 "Tipo", which is extremely scanty, and LPS 3676 "Co-tipo", a rich collection. As lectotype, I am designating the specimen from Argentina, Mendoza, 5.XII.1902, C. Spegazzini, LPS 3676!

Durán & Fischer, 1961:30, demonstrated that *T. eremophila* is a synonym of ***T. asperifolia*** Ellis & Everhart, type on *Sporobolus asperifolius* Nees & Mey. (= *Muhlenbergia asperifolia* (Nees & Mey.) Parodi), USA. (syn. confirmed).

Spegazzini, 1884a:88, published ***Ustilago paraguayensis*** Speg. — Type "ad paniculas foemineas Graminaceae monoicae elatioris (an bambusaceae?)", Paraguay, Cordillera de Peribebuy, 2.IV.1883, B. Balansa 3776.

In LPS there are two envelopes of this collection: LPS 3704 and LPS 3705. Of these, I am proposing as lectotype the richer one, that of LPS 3704, which is also associated with measurements and drawings of the spores, made by Spegazzini.

THE SMUT FUNGI OF *SCHIZACHYRIUM* (GRAMINEAE)

Schizachyrium Nees, with c. 60 species throughout the tropics, belongs to the subfam. Panicoideae, tribe Andropogoneae, subtribe Anropogoninae (Clayton & Renvoize, 1986:352). On *Schizachyrium* two smut fungi are known. Three additional species are described below.

1. *Sporisorium absconditum* Vánky, sp. nov.

Typus in matrice *Schizachyrium fragile* (R. Br.) A. Camus, Australia, Queensland, 56 km SW oppid. Mount Garnet, Forty Mile Scrub National Park, 18°03'21" S, 144°51'58" E, alt. cca. 770 m.s.m., 6.IV.1998, leg. C. & K. Vánky. Holotypus in BRIP, isotypi in Herbario Ustil. Vánky, HUV 19960, et in Vánky, Ust. exs. no. 1167. Paratypus in matrice *Schizachyrium sanguineum* (Retz.) Alston, Venezuela, Estado Aragua, cca. 23 km N urbe La Victoria, 10°26' N, 67°19' W, alt. cca. 2020 m.s.m., 14.XII.1993, leg. R. Berndt, C. & K. Vánky, HUV 19966, isoparatypus in BPI.

Sori racemos destruentes, anguste cylindrici, 0,5–1 x 15–30 mm, spatheolo tubuliformi paene complete obtecti, apice tantum protrudentes, peridio tenui, pallide brunneo cooperti, quo a parte distali rupto massam nigram, granuloso-pulveream glomerulorum sporarum columellamque longam, filiformem ostendentes. Saepe surculi omnes eiusdem plantae infecti, sed non raro planta infecta cum surculo unico in flore, vel surculis nonnullis florentibus proveniens. *Glomeruli sporarum* persistentes, subglobosi, ovoidei, ellipsoidales usque irregulares, 50–80 x 50–100 µm, atro-rubrobrunnei, opaci, e sporis aliquoties decem, pressu valido tantum separabilibus compositi. *Sporae* dimorphae, externae earum subgloboae, ellipsoidales usque subpolyedrice irregulares, 8–12 x 10,5–13,5 µm, atro-flavidobrunneae; pariete inaequali, alternatim tenue vel incrassato, 0,5–2 µm, areas atriores et pallidiores sporarum provocantes; superficies libera sporarum externarum dense verrucosa; imago obliqua sporarum externarum in superficie libera serrulata, in lateribus contactis levis; sporae internae subpolyedrice irregulares, sporis externis magnitudine circiter aequales, subhyalinae usque pallide flavidobrunneae; pariete tenui, usque cca. 0,5 µm, levi. *Cellulae steriles* absentes.

Sori (Fig. 21) destroying the racemes, narrow-cylindrical, 0.5–1 x 15–30 mm, almost completely hidden by the tubuliform spatheole, with only their tip protruding, covered by a thin, pale brown peridium which ruptures from its distal part, disclosing the black, granular powdery mass of spore balls and a long, filiform columella. Often all shoots of a plant are infected, but not rarely, an infected plant may have one or several flowering shoots. *Spore balls* (Figs. 23, 24) persistent, subglobose, ovoid, ellipsoidal or irregular, 50–80 x 50–100 µm, dark reddish-brown, opaque, composed of tens of spores which separate only by hard pressure. *Spores* (Figs. 23, 24) dimorphic, outer spores subglobose, ellipsoidal to subpolyhedrally irregular, 8–12 x 10.5–13.5 µm, dark yellowish-brown; wall uneven, alternatively thin and thick, 0.5–2 µm, causing darker and lighter areas on the spores; free surface of the outer spores coarsely verrucose; spore profile serrulate on the free surface, smooth on the contact sides; inner spores subpolyhedrally irregular, about the size of the outer spores, subhyaline to pale yellowish-brown; wall thin, up to c. 0.5 µm, smooth. *Sterile cells* absent.

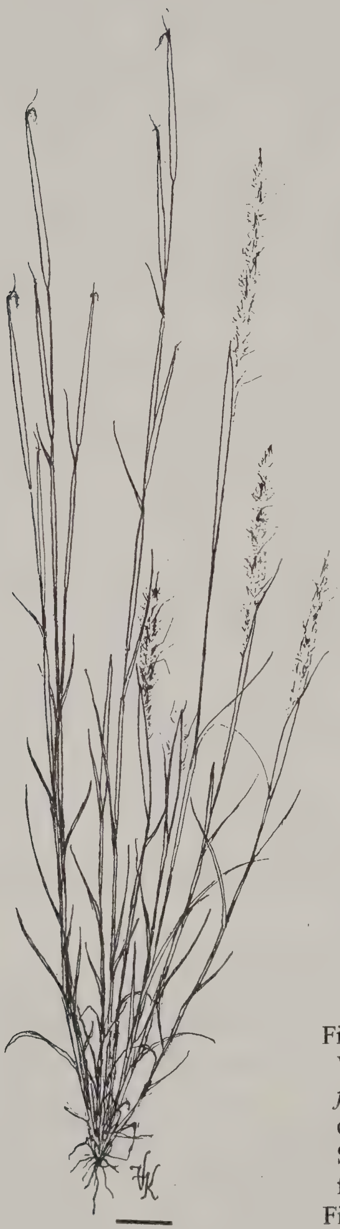
On *Schizachyrium fragile* (R. Br.) A. Camus, *S. sanguineum* (Retz.) Alston; S. America (Venezuela), Australasia (Australia).

Etymology: from the Latin *absconditus, -a, -um* = hidden, concealed, referring to the hidden position of the sori.

2. ***Sporisorium berndtii*** Vánky, **sp. nov.**

Typus in matrice *Schizachyrium sanguineum* (Retz.) Alston (det. H. Scholz, B), Sumatra, Samosir Island, Toba Lake, Pangururan Hot Springs, 20.VIII.1997, leg. V. Faust-Berndt & R. Berndt. Holotypus in Herbario Ustil. Vánky, HUV 19957, isotypus in BPI.

Sori in ovariis et organis internis floralibus spiculorum nonnullorum sessilium inflorescentiae eiusdem, cylindrici, arcuati vel torti, cca. 1 x 5–20 mm, inter glumis protrudens, primum peridio pallide cinerescenti cooperti, quo in medio soris longitudinaliter fisso massam atrobrunneam, pulveream glomerulorum sporarum, sporarum et columellarum (1–)2–4(–5), filiformium ostendentes. *Glomeruli sporarum* laxi, forma et magnitudine varii, ellipsoidales, elongati vel



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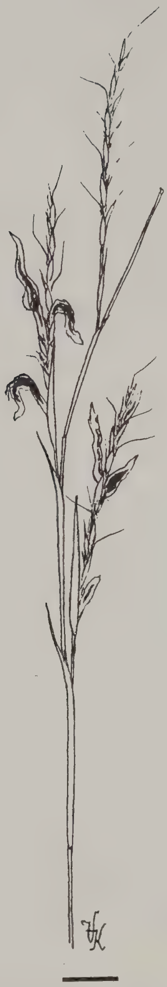

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Fig. 21. Sori of *Sporisorium absconditum* Vánky in the racemes of *Schizachyrium fragile* (R. Br.) A. Camus (type), almost completely hidden by the spatheolae. Some shoots escaped infection and are flowering. Habit. Bar = 1 cm.

Fig. 22. Sori of *Sporisorium berndtii* Vánky in some flowers of *Schizachyrium sanguineum* (Retz.) A. Camus (type). Habit. Bar = 1 cm.

irregulares, 35–90 x 50–130 µm, atro-rubrobrunnei, e sporis pluribus decem vel pluribus centum, valde leviter separabilibus compositi. *Sporae* globosae, ovoideae, ellipsoidales usque subpolyedrice parum irregulares, 8–10,5 x 9–12 µm, pallide usque atro-flavidobrunneae; pariete aequali usque inaequaliter crasso, 0,5–1(–1,5) µm, ad sporas externas crassiore et simul parum obscuriore, surficie leniter, dense punctato-verrucoso; imago obliqua sporarum levis, usque leniter undulata. *Cellulae steriles* nullae.

Sori (Fig. 22) in ovaries and inner floral organs of some sessile spikelets of an inflorescence, cylindrical, bent or twisted, c. 1 x 5–20 mm, protruding between the glumes, first covered by a pale greyish peridium which splits longitudinally in the middle of the sorus disclosing the dark brown, powdery mass of spore balls, spores, and (1–)2–4(–5), filiform columellae. *Spore balls* (Figs. 25, 26) loose, variable in shape and size, ellipsoidal, elongated or irregular, 35–90 x 50–130 µm, dark reddish-brown, composed of tens or hundreds of spores which separate very easily. *Spores* (Figs. 25, 26) globose, ovoid, ellipsoidal to subpolyhedrally slightly irregular, 8–10.5 x 9–12 µm, pale to dark yellowish-brown; wall evenly to unevenly thick, 0.5–1(–1.5) µm, thicker on the outer spores which are also somewhat darker, surface finely, densely punctate-verrucose; spore profile smooth to finely wavy. *Sterile cells* absent.

On *Schizachyrium sanguineum* (Retz.) Alston, Indonesia (Sumatra).

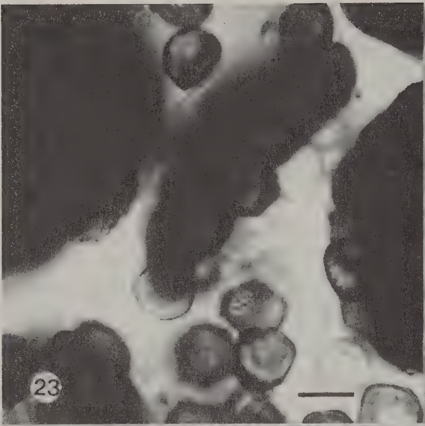
Etymology: This fungus is named in honour of Dr. Reinhard Berndt (Tübingen, Germany), excellent rust fungus specialist and friend, who also collected many interesting smut fungi, including this species.

3. ***Sporisorium guaraniticum*** (Speg.) Vánky, 1989:155.

Ustilago guaranitica Spegazzini, 1884a:87. — *Sphacelotheca guaranitica* (Speg.) Zundel, 1930:135. — *Sorosporium guaraniticum* (Speg.) L. Ling, 1953a:190. — Type on *Andropogon condensatus* Kunth (= *Schizachyrium condensatum* (Kunth) Nees), Paraguay, between Paraguari and Valenzuela, V.1883, B. Balansa 3739, LPS 3050. Isotypes HMAS, HUV 12065!

Sori destroying the racemes, linear, 2–3 cm long, partly hidden by the spathae, first covered by a thin peridium which ruptures irregularly disclosing the blackish-brown, granular-powdery mass of spore balls and a long, slender, filiform columella. *Spore balls* loose, subglobose, ellipsoidal, elongated or irregular, 40–80 x 50–120 µm, light to medium reddish-brown, composed of 20 to hundreds of spores which separate easily. *Spores* globose, subglobose or slightly irregular, usually ellipsoidal, 12–16 x 13–20 µm, yellowish-brown, free surface of the outer spores finely, densely verruculose which just affects the spore profile, inner spores apparently smooth, in SEM very finely verruculose; wall typically unevenly thickened, with (0–)2–4(–6) protuberances or thicker (0.8–2.5 µm) and darker areas, alternating with thin-walled (0.5–1 µm) and light areas. *Sterile cells* absent.

On *Schizachyrium condensatum* (Kunth) Nees, *S. sanguineum* (Retz.) Alston; S. America (Argentina, Ecuador, Paraguay, Venezuela), Australasia (Australia).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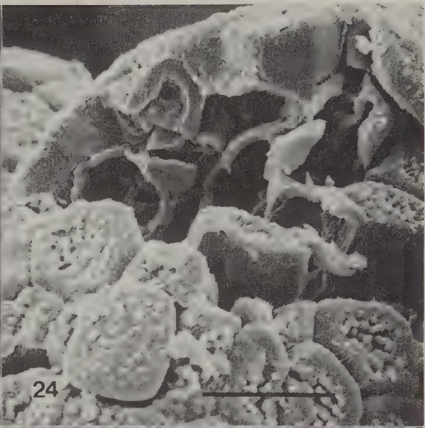
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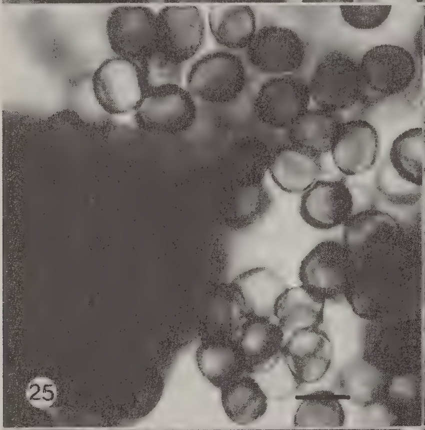
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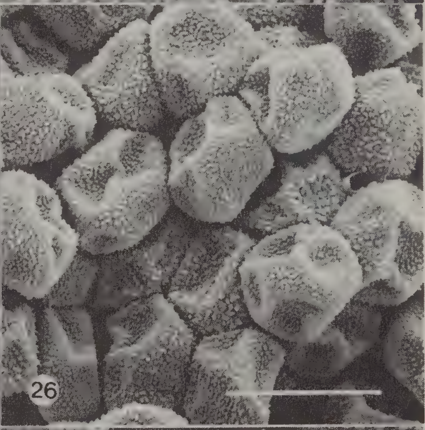
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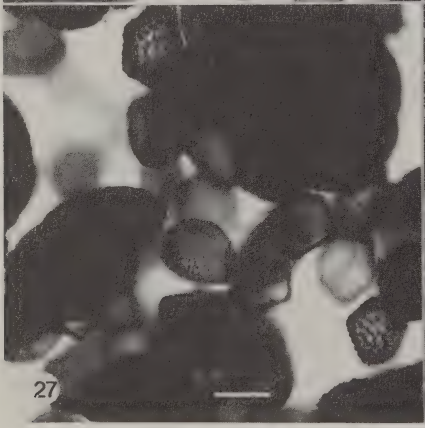
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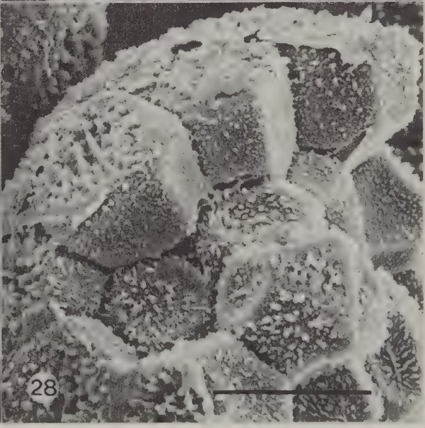
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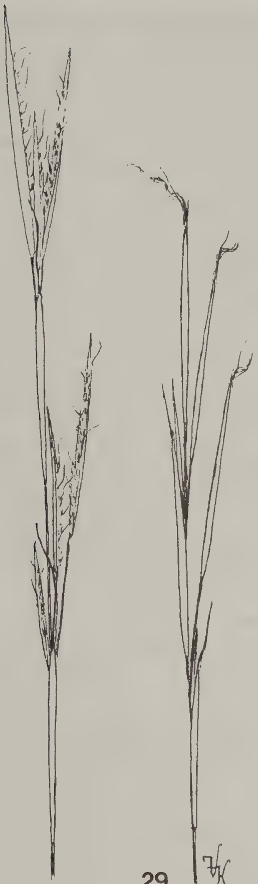

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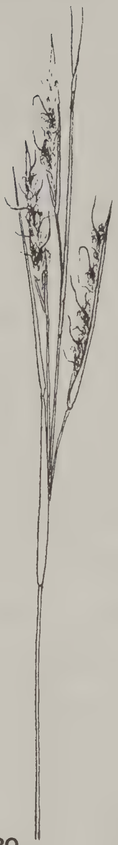

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Fig. 29. Sori of *Sporisorium zambianum* Vánky in the racemes of *Schizachyrium exile* (Hochst.) Pilger, almost completely hidden by the spatheolae (type). To the left a healthy inflorescence. Habit.

Fig. 30. Sori of *Sporisorium schizachyrii* Vánky in the ovaries of *Schizachyrium exile* (Hochst.) Pilger (type). Habit. Bar = 1 cm.

Figs. 23, 24. Spore balls and spores of *Sporisorium absconditum* Vánky on *Schizachyrium fragile* (R. Br.) A. Camus, in LM and in SEM (type).

Figs. 25, 26. Spore balls and spores of *Sporisorium berndtii* Vánky on *Schizachyrium sanguineum* (Retz.) A. Camus (type).

Figs. 27, 28. Spore balls and spores of *Sporisorium zambianum* Vánky on *Schizachyrium exile* (Hochst.) Pilger, in LM and in SEM (type). Bars = 10 µm.

4. *Sporisorium schizachyrii* Vánky, 2002a:418.

Type on *Schizachyrium exile* (Hochst.) Pilger, Zambia, Southern Prov., 75 km ESE Kafue, Chirundu Fossil Forest, alt. 490 m, 28.IV.2001, C. & K. Vánky, HUV 19654. Isotypes in Vánky, Ust. exs. no. 1128.

For description and illustrations see Vánky, 2002a:418-421. See also Fig. 30.

On *Schizachyrium exile* (Hochst.) Pilger, and *S. sanguineum* (Retz.) Alston; C. Africa (Zambia), S. America (Venezuela).

The South American specimens on *Schizachyrium sanguineum* have 1–5 columellae, whereas in the African specimens on *S. exile* there is only one columella in a sorus. Other characters are identical.

5. *Sporisorium zambianum* Vánky, sp. nov.

Typus in matrice *Schizachyrium exile* (Hochst.) Pilger, Zambia, Lusaka Prov., 169 km ENE Lusaka, 15°04'10" S, 29°45'22" E, alt. cca. 900 m.s.m., 17.IV.2001, C., T. & K. Vánky, HUV 19963. Isotypes in BPI, IMI et K.

Sori racemos destruentes, longe cylindrici, 0,5–1 x 20–40 mm, spatheolo tubuliformi obtecti excepta parte distali eorum, primum peridio tenue, pallide brunneo cooperti, quo rupto et ab apice disjuncto, massam nigrobrunneam, granuloso-pulveream glomerulorum sporarum columellamque longam, filiformem ostendentes. *Glomeruli sporarum* globosi, subglobosi, ovoidei, usque late ellipsoidales, 30–50 x 40–60 μm, atro-rubrobrunnei usque opaci, e sporis nonnullis decem, pressu leviter separabilibus compositi. *Sporae* forma variae, subpolyedrice vel polyedrice irregulares, 9–15 x 10,5–17 μm, atro-flavido- usque atro-rubrobrunneae; pariete inaequaliter crasso, 0,5–2,5(–3) μm, superficies libera sporarum externarum prominenter echinulata, spinis 1–2 μm altis; sporae internae pallidiores, leniter, disperse punctatae-verrucosae; pariete tenui, cca. 0,5 μm, saepe ad angulos crassiore. *Cellulae steriles* nullae.

Sori (Fig. 29) destroying the racemes, long-cylindrical, 0.5–1 x 20–40 mm, hidden by the tubuliform spatheole except its distal part, first covered by a thin, pale brown peridium which ruptures and dehisces from its apex, disclosing the blackish-brown, granular powdery mass of spore balls and a long, filiform columella. *Spore balls* (Figs. 27, 28) globose, subglobose, ovoid, to broadly ellipsoidal, 30–50 x 40–60 μm, dark reddish-brown to opaque, composed of a few tens of spores which separate easily by pressure. *Spores* (Figs. 27, 28) variable in shape, subpolyhedrally or polyhedrally irregular, 9–15 x 10.5–17 μm, dark yellowish- to dark reddish-brown; wall unevenly thick, 0.5–2.5(–3) μm, free surface of the outer spores prominently echinulate, spines 1–2 μm high; inner spores lighter, finely, sparsely punctate-verrucose; wall thin, c. 0.5 μm, often thicker at the angles. *Sterile cells* absent.

On *Schizachyrium exile* (Hochst.) Pilger; C. Africa (Zambia).

Key to the smut fungi of *Schizachyrium*

(*S.* = *Sporisorium*)

1. Sori destroying the racemes 2
– Sori in the spikelets 4
2. Spores 13–20 µm long, free surface finely verruculose .... ***S. guaraniticum***
– Spores smaller, free surface coarsely ornamented 3
3. Spores 10.5–17 µm long, free surface coarsely echinulate .... ***S. zambianum***
– Spores 10.5–13.5 µm long, free surface coarsely verrucose ...... ***S. absconditum***
4. Spores dimorphic, i.e. outer and inner spores in a ball very different, 8–10.5 µm long, free surface echinulate .... ***S. schizachyrii***
– Spores not dimorphic, 9–12 µm long, punctate-verrucose .... ***S. berndtii***

A NEW SMUT FUNGUS OF *ELIONURUS* (GRAMINEAE)

Two smut fungi are known on *Elionurus*: ***Sporisorium elionuri*** (Henn. & Pole-Evans) Vánky, on *Elionurus muticus* (Spreng.) Kunth, in Africa and South America, and ***S. elionuri-tristis*** Vánky, on *Elionurus tristis* Hack., in Madagascar (comp. Vánky, 1999:155-158). An additional smut fungus, collected in Zambia is:

Macalpinomyces elionuri-tripsacoidis Vánky, **sp. nov.**

Typus in matrice *Elionurus tripsacoides* Willd., Zambia, Southern Prov., 70 km SW Lusaka, 15°55'29" S, 28°10'00" E, alt. cca. 1060 m.s.m., 16.IV.2001, leg. T., C. & K. Vánky. Holotypus in Herbario Ustil. Vánky, HUV 19956. Isotypi in BPI, IMI et K. Paratypi in matrice *Elionurus tripsacoides* Willd., Zambia, Southern Prov., 22 km NE Pemba, 16°23'03" S, 27°2924" E, alt. cca. 1060 m.s.m., 12.IV.2001, leg. C., T. & K. Vánky, HUV 19959, isoparatypus in BPI; Southern Prov., 87 km NNE Livingstone, 17°16'19" S, 26°15'01" E, alt. cca. 1210 m.s.m., 14.IV.2001, leg. C., T. & K. Vánky, HUV 19958.

Sori in ovariis spiculorum nonnulorum sessilium, hermaphroditorum, longe cylindrici, deinde torti, 0,7–1 x 5–30 mm, peridio brunneo cooperti, qua longitudinaliter rupta et lacerata massam olivaceobrunneam, semiagglutinatam usque pulveream sporarum et cellularum sterilium ostendentes. *Sporae* globosae, subglobosae usque ellipsoidales, magnitudine variae, 5,5–9,5(–10,5) x 6,5–10,5(–12) µm, flavidobrunneae; pariete aequali, 1–1,5 µm crasso, spinis obtusis, brevibus inclusis; imago obliqua sporarum serrata. *Cellulae steriles* in catervis magnis, laxis, cellulae singulae globosae usque ovoideae, 4–9,5 x 6,5–10,5 µm, hyalinae; pariete tenui, 0,3–0,4 µm, levi.

Sori (Fig. 31) in the ovaries of some of the sessile, hermaphrodite spikelets, long cylindrical, later twisted, 0.7–1 x 5–30 mm, covered by a brown peridium which ruptures and shreds longitudinally disclosing the olivaceous-brown, semiagglutinate to powdery mass of spores and sterile cells. *Spores* (Figs. 32, 33) globose, subglobose to ellipsoidal, variable in size, 5.5–9.5(–10.5) x

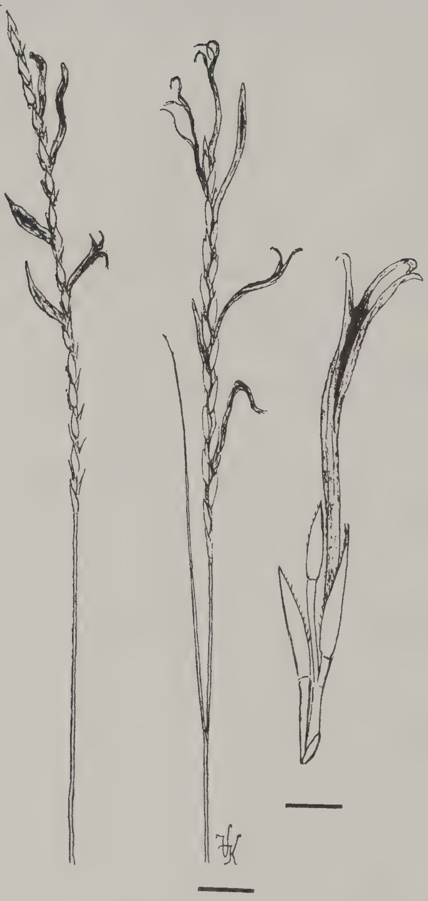

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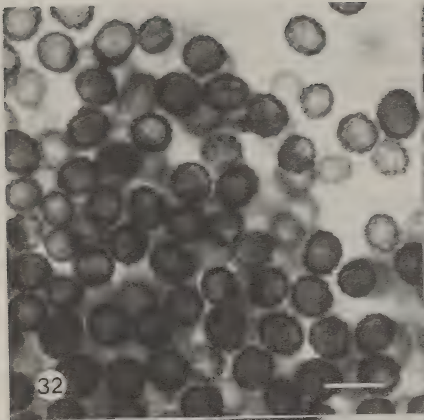
Fig. 31. Sori of *Macalpinomyces elionuri-tripsacoidis* Vánky in some ovaries of *Elionurus tripsacoides* Willd. (type). Habit. Enlarged two healthy spikelets and a sorus. Bars = 1 cm for habit, 3 mm for the detail drawing.

Figs. 32, 33. Spores and sterile cells of *Macalpinomyces elionuri-tripsacoidis* Vánky on *Elionurus tripsacoides* Willd., in LM and in SEM (type).

Figs. 34, 35. Spore balls and spores of *Sporisorium tristachyae-nodiglumis* Vánky on *Tristachya nodiglumis* K. Schum., in LM and in SEM (type).

Figs. 36, 37. Spore balls and spores of *Restiosporium dapsilanthi* Vánky on *Dapsilanthus elatior* (R. Braun) B.G. Briggs & L.A. Johnson, in LM and in SEM (type). Bars = 10 µm.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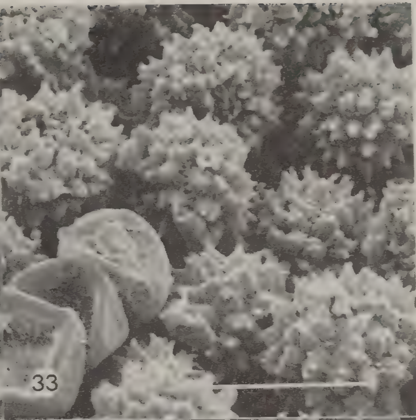
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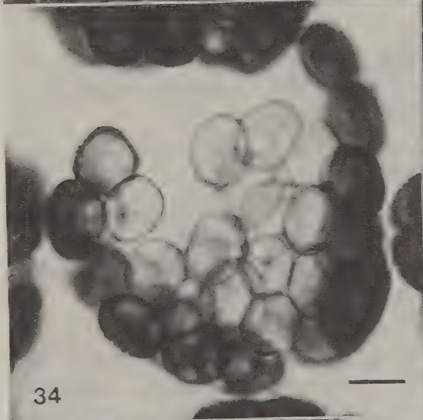
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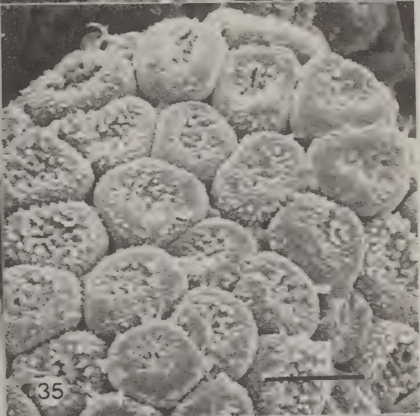
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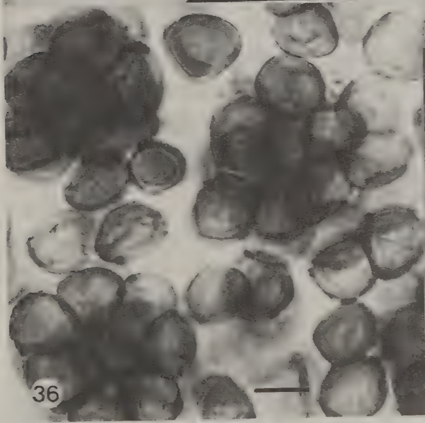
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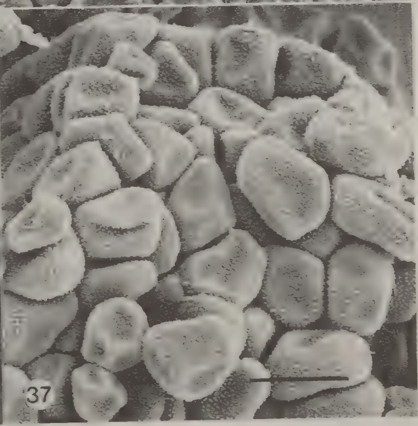
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6.5–10.5(–12) µm, yellowish-brown; wall even, 1–1.5 µm thick, including the short, conical spines; spore profile serrate. *Sterile cells* (Figs. 32, 33) in large, loose groups, single cells globose to ovoid, 4–9.5 x 6.5–10.5 µm, hyaline; wall thin, 0.3–0.4 µm, smooth.

On *Elionurus tripsacoides* Willd.; C. Africa (Zambia).

Key to the smut fungi of *Elionurus*

1. Spores with conical spines .... ***Macalpinomyces elionuri-tripsacoidis***
– Spores finely verruculose or finely echinulate 2
2. Spores 6.5–9.5(–10.5) µm long. Sterile cells absent .... ***Sporisorium elionuri***
– Spores 10–13 µm long. Sterile cells present .... ***Sporisorium elionuri-tristis***

A NEW SMUT FUNGUS OF *TRISTACHYA* (GRAMINEAE)

I revised the smut fungi of the closely related *Loudetia*, *Trichopteryx*, *Tristachya* and *Zonotriche* (Vánky, 1997:160-171) and recognised ten species, of which six are *Sporisorium*. A different species was collected in Zambia:

Sporisorium tristachyae-nodiglumis Vánky, sp. nov.

Typus in matrice *Tristachya nodiglumis* K. Schum., Zambia, Lusaka Province, 169 km ENE urbe Lusaka, 15°04'10" S, 29°45'22" E, alt. cca. 900 m.s.m., 17.IV.2001, leg. C., T. & K. Vánky. Holotypus in Herbario Ustil. Vánky, HUV 19719, isotypi in Vánky, Ust. exs. no. 1144.

Sori in flosculis, organa floralia intima destruentes, cylindrici, cca. 1 x 15–25 mm, involucris floralibus partim cooperti, primo peridio crasso, pallide flavidobrunneo obtecti, quo irregulariter rupto massam nigram, granuloso-pulveream glomerulorum sporarum, columellas 3–4, filiformes circumdantem ostendentes. Infectio systemica: plerumque spiculae omnes inflorescentiae eiusdem affectae. *Glomeruli sporarum* permanentes, forma et magnitudine varii, subglobosi, ellipsoidales, elongati, plerumque parum irregulares, 30–90 x 40–110(–140) µm, rufobrunnei usque subopaci, e sporis 15 usque pluries decem vel etiam centum(?) compositi. *Sporae* dimorphae. Sporae externae ellipsoidales, ovoideae, plerumque subpolyedrice irregulares, 9,5–13 x 10–15(–16) µm, atro-rufobrunneae; pariete inaequali, in latere interno cca. 0,5 µm, in latere libero, externo usque 2,5 µm crasso, verrucis vel spinis dense dispositis, cca. 1 µm altis inclusis; imago obliqua sporae dense serrulata. Sporae internae magis rotundae, subglobosae, ellipsoidales vel parum subpolyedricae, 9,5–12 x 10–13,5 µm, subhyalinae; pariete aequaliter crasso (cca. 0,5 µm), levi. *Cellulae steriles* nullae.

Sori (Fig. 38) in the florets, destroying the innermost floral organs, cylindrical, c. 1 x 15–25 mm, partly hidden by the floral envelopes, first covered by a thick, pale yellowish-brown peridium which ruptures irregularly disclosing the black, granular-powdery mass of spore balls surrounding 3–4 filiform columellae.

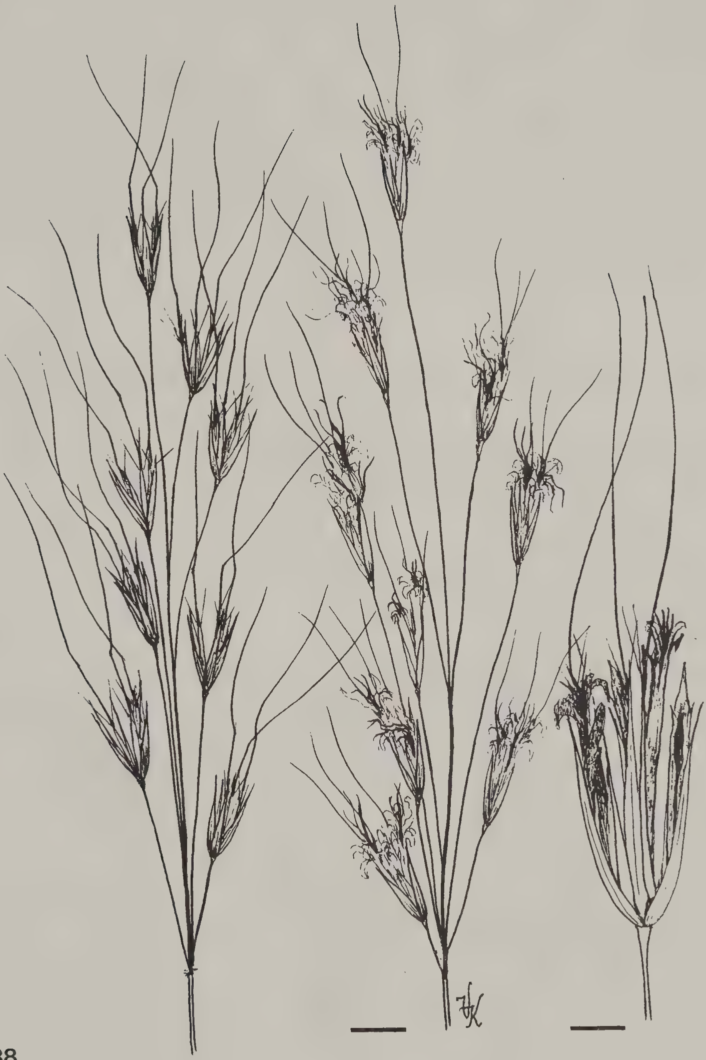

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Fig. 38. Sori of *Sporisorium tristachyae-nodiglumis* Vánky in the florets of *Tristachya nodiglumis* K. Schum. (type). Habit, a healthy inflorescence (to the left) and enlarged a triplet of spikelets, each with two sori in the two florets. Bars = 1 cm for habit, 4 mm for the detail drawing.

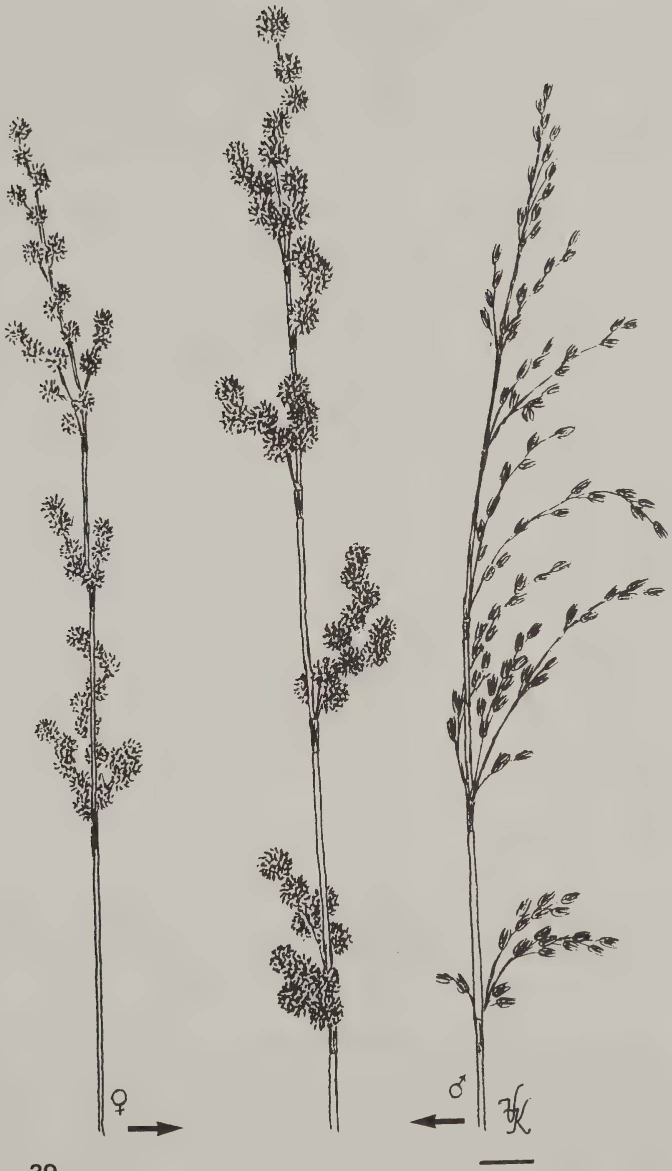
Infection systemic; usually all spikelets of an inflorescence are affected. *Spore balls* (Figs. 34, 35) permanent, variable in shape and size, subglobose, ellipsoidal, elongated, usually slightly irregular, 30–90 x 40–110(–140) µm, reddish-brown to subopaque, composed of 15 to tens or a hundred(?) spores. *Spores* (Figs. 34, 35) dimorphic. Outer spores ellipsoidal, ovoid, usually subpolyhedrally irregular, 9.5–13 x 10–15(–16) µm, dark reddish-brown; wall uneven, on the inner side c. 0.5 µm, on the outer, free side up to 2.5 µm thick, including the c. 1 µm high, densely situated warts or spines; spore profile serrulate. Inner spores more rounded, subglobose, ellipsoidal or slightly subpolyhedral, 9.5–12 x 10–13.5 µm, subhyaline; wall evenly thick (c. 0.5 µm), smooth. *Sterile cells* absent.

On *Tristachya nodiglumis* K. Schum., C. Africa (Zambia).

Key to the *Sporisorium* species of *Loudetia*, *Trichopteryx*, *Tristachya* and *Zonotriche*

1. Sori comprise the whole inflorescence........................***S. loudetiae-pedicellatae***
– Sori restricted to the spikelets (ovaries or florets)...2
2. Columellae more than 8. Spore balls evanescent. Spores all alike,
6–11 µm long...***S. catinatum***
– Columellae less than 5. Spore balls more or less permanent.
Spores more or less dimorphic, larger..3
3. Spores 11–22 µm long..***S. loudetiae-superbae***
– Spores smaller..4
4. Spores 12–17 µm long. Contact wall of the outer spores thicker
(c. 1.5 µm) than the free wall (c. 1 µm).....................................***S. tristachydis***
– Spores smaller. Contact wall of the outer spores thinner than or
equalling the thickness of the free wall 5
5. Columellae 1–3. Spore balls 25–65 µm long..................................***S. decorsei***
– Columellae 3–5. Spore balls larger 6
6. Spore balls 35–90 µm long. Free surface of the spores finely
verruculose. Spore profile nearly smooth.....................***S. tristachyae-hispidae***
– Spore balls 40–110(–140) µm long. Free surface of the spores
verrucose-echinulate. Spore profile serrulate ....***S. tristachyae-nodiglumis***

Fig. 39. Sori of *Restiosporium dapsilanthi* Vánky in the seeds of *Dapsilanthus elatior* (R. Braun) B.G. Briggs & L.A. Johnson (type). To the left a healthy female inflorescence, to the right a healthy male inflorescence, in the middle an infected male or female inflorescence (habit). Bar = 1 cm.



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A NEW SMUT FUNGUS ON *DAPSILANTHUS* (RESTIONACEAE)

Restiosporium dapsilanthi Vánky, sp. nov.

Typus in matrice *Dapsilanthus elatior* (R. Braun) B.G. Briggs & L.A. Johnson (*Leptocarpus elatior* R. Brown; det. B. Waterhouse), Australia, Queensland, Cape York Peninsula, Bamaga, near the Air Port, 11°51'07" S, 146°29'18" E, alt. cca. 10 m.s.m., 8.III.2000, leg. R.G. Shivas, C. & K. Vánky, BRIP. Isotypi in BPI 841710, IMI, in Herbario Ustil. Vánky, HUV 19260, et in Vánky, Ust. exs. no. 1149.

Sori in nucibus, ovoidei, apice acuti, cca. 0,5 x 1 mm, semina massa glomerulorum sporarum granulosa-pulverea, nigra substituentes. Fungus proliferationem inflorescentiae et simul transformationem eius producens; per soros plantae masculinae infectae in femineis transformatae. *Glomeruli sporarum* subglobosi, ellipsoidales usque irregulares, 20–50 x 25–60 µm, atro olivaceobrunnei, e sporis 4–40 (vel pluribus?), faciliter separabilibus compositi. *Sporae* subglobosae, ovoideae, ellipsoidales usque subpolyedrice irregulares, 9–13 x 11–16(–17) µm, olivaceobrunneae; pariete aequaliter crasso, 1–2 µm, conspicue levi usque leniter, dense punctato, in SEM leniter, dense verruculoso.

Sori (Fig. 39) in the nuts, ovoid with an acute tip, c. 0.5 x 1 mm, replacing the seeds with a black, granular-powdery mass of spore balls. The fungus produces proliferation of the inflorescence and also transvestism; infected male plants are transformed into female ones with sori. *Spore balls* (Figs. 36, 37) subglobose, ellipsoidal to irregular, 20–50 x 25–60 µm, dark olivaceous-brown, composed of 4–40 (or more?), easily separating spores. *Spores* (Figs. 36, 37) subglobose, ovoid, ellipsoidal to subpolyhedrally irregular, 9–13 x 11–16(–17) µm, olivaceous-brown; wall evenly thick, 1–2 µm, apparently smooth to finely, densely punctate, in SEM finely, densely verruculose.

On Restionaceae: *Dapsilanthus elatior* (R. Braun) B.G. Briggs & L.A. Johnson (*Leptocarpus elatior* R. Brown); Australia.

A NEW SPECIES OF *MACALPINOMYCES*

Of the 25 known *Macalpinomyces* species six form sori on the top of sterile shoots of Gramineae (*Capillipedium, Chrysopogon, Loudetia, Trichopteryx, Tristachya, Vetiveria*). Recently, a different *Macalpinomyces* species was collected in Uganda, on both *Sorghastrum* and *Loudetia*:

Macalpinomyces ugandensis Vánky, sp. nov.

Typus in matrice *Sorghastrum stipoides* (Kunth) Nash (det. M. Namaganda, MHU), Uganda, Rakai Distr., 40 km SW urbe Masaka, 6 km NE pag. Kyotera, 00°35'37" S, 31°35'13" E, alt. cca. 1190 m.s.m., 27.II.2002, leg. T., C. & K. Vánky. Holotypus in Herbario Ustil. Vánky, HUV 19992, isotypi in MHU, BPI et in Vánky, Ust. exs. no. 1177. Paratypus in matrice *Loudetia phragmitoides* (Peter) C.E. Hubb. (det. M. Namaganda); the same place, date and collectors as the type, HUV 19993. Isoparatypes in MHU, BPI et K.

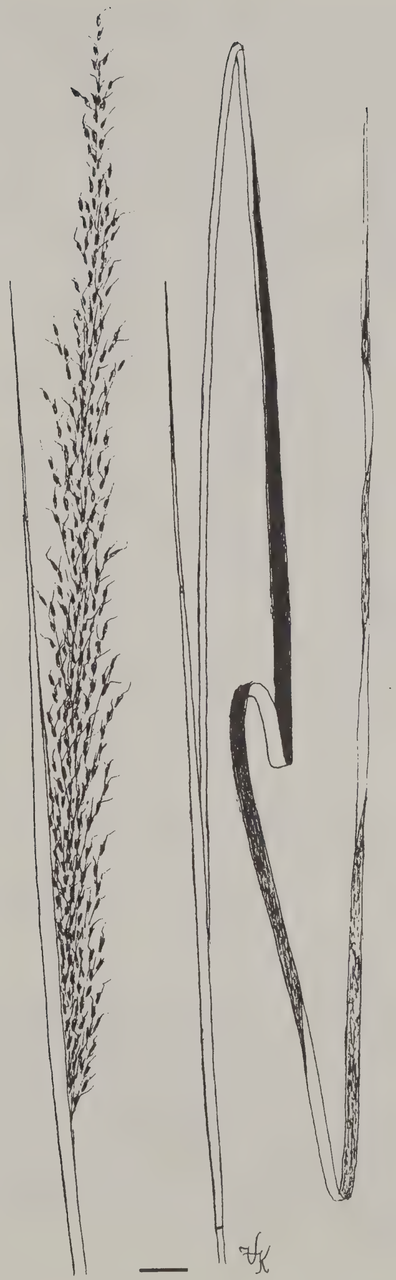

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Fig. 40. A sorus of *Macalpinomyces ugandensis* Vánky on the top of a sterile shoot of *Sorghastrum stipoides* (Kunth) Nash, as a tube filled with spores, which splits at maturity (type). To the left a healthy inflorescence.
Bar = 1 cm.

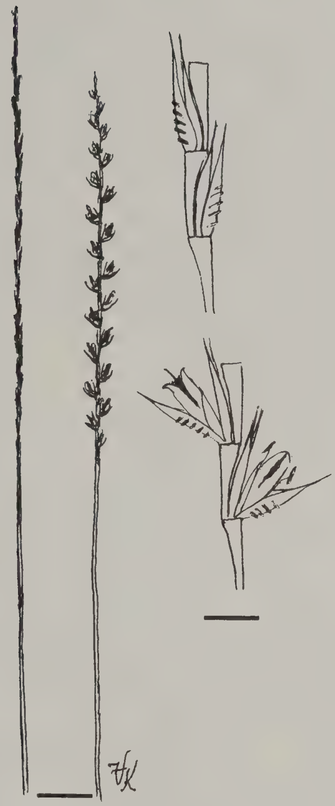
Sori in apice surculorum, tubos flagelliformes, usque 1 m longos et 1–3 mm latos telarum hostilium massis nigrobrunneis, agglutinatis sporarum et cellularum relative paucarum intermixtarum completos formantes. Maturitate tubi e medio vel a parte distali eorum longitudinaliter fissi, massae sporarum dispersae et tubi aperti ligamenta typica, torta, persistentes formantes. Infectio systemica. Plerumque surculi omnes plantae eiusdem infecti et steriles. *Sporae* maturae singulae, globosae, subglobosae usque late ellipsoidales, 10,5–13,5 x 12–14,5 µm, saepe lateraliter parum deplanatae (8,5–10,5 µm lata), flavido- usque olivaceobrunneae; pariete aequali, cca. 1 µm crasso, dense, prominenter echinulato; imago obliqua sporarum serrulata. *Cellulae steriles* globosae usque ellipsoidales, in catervis laxis vel singulae, magnitudine extreme variae, 6–26 µm longae, hyalinae; pariete aequali, 0,5–2,5 µm crasso, levi.

Sori (Fig. 40) on the top of shoots forming flagelliform tubes of host tissue, up to 1 m long, 1–3 mm wide, filled with blackish-brown, agglutinated masses of spores intermixed with relatively few sterile cells. At maturity, the tubes split longitudinally, starting from their middle or distal part, the spore masses are scattered and the opened tubes form typical, persistent, twisted bands. Infection systemic. Usually all shoots of a plant are affected and remain sterile. *Spores* (Figs. 43, 44) single when mature, globose, subglobose to broadly ellipsoidal, 10.5–13.5 x 12–14.5 µm, often laterally slightly flattened (8.5–10.5 µm wide), yellowish- to olivaceous-brown; wall even, c. 1 µm thick, densely, prominently echinulate; spore profile serrulate. *Sterile cells* (Figs. 43, 44) globose to ellipsoidal, in small, loose groups or single, extremely variable in size, 6–26 µm long, hyaline; wall even, 0.5–2.5 µm thick, smooth.

On *Sorghastrum stipoides* (Kunth) Nash and *Loudetia phragmitoides* (Peter) C.E. Hubb.; C. Africa (Uganda). Known from the type collections only.

Key to the *Macalpinomyces* species with sori on the top of sterile shoots

1. Spores 4–6.5 µm long, verrucose .... ***M. effusus***
– Spores larger 2
2. Spores 7–9 µm long, wall unevenly thick, 0.5–1.5 µm .... ***M. tristachyae***
– Spores larger, wall evenly or unevenly thick 3
3. Spores 8–12 µm long 4
– Spores larger 6
4. Sterile cells 12–35 µm long, wall thick (2.5–3 µm) .... ***M. trichopterygis***
– Sterile cells 5–15 µm long, wall thin (c. 0.5 µm) 5
5. Spores coarsely, moderately densely, low echinulate .... ***M. chrysopogonicola***
– Spores finely, densely verruculose .... ***M. nigritanae***
6(3). Spores 9–15 µm long, often acuminate, finely verrucose;
spore profile wavy .... ***M. simplex***
– Spores 12–14.5 µm long, never acuminate, densely echinulate;
spore profile serrulate .... ***M. ugandensis***



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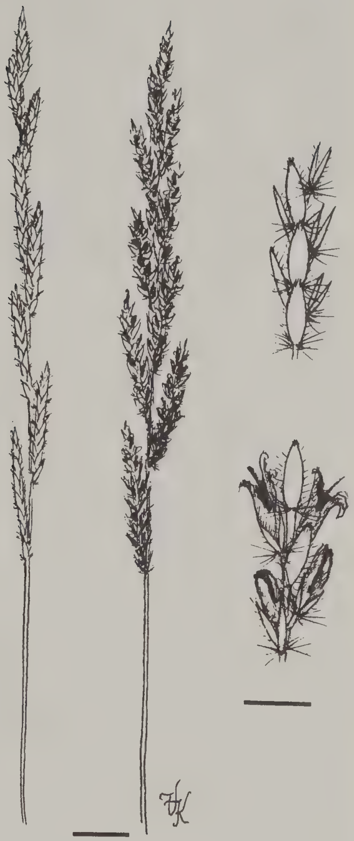

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Fig. 41. Sori of *Sporisorium rhytachnes-rottboellioidis* Vánky in the ovaries of *Rhytachne rottboellioides* Desv. (type). An infected and a healthy inflorescence (habit). Enlarged, two healthy and two infected spikelets (below). Bars = 1 cm for habit, 2 mm for the detail drawings.

Fig. 42. Sori of *Sporisorium eriochrysis* Vánky in both sessile and pedicelled spikelets of *Eriochrysis brachypogon* (Stapf) Stapf (type). An infected and a healthy inflorescence (habit). Enlarged, some healthy and some infected spikelets. Bars = 1 cm for habit, 3 mm for the detail drawings.

A NEW *SPORISORIUM* SPECIES ON *RHYTACHNE* (GRAMINEAE)

I revised (Vánky, 2000:168-172) the smut fungi of *Rhytachne* and similar grass genera. On *Rhytachne* two smut fungi have been recognised: *Sporisorium rhytachnes* (H. Sydow) Vánky, destroying the whole inflorescence of *R. triaristata* Stapf (Sierra Leone), and *Tolyposporella rhytachnes* Viennot-Bourgin, on the leaves of *R. minor* Pilger (Guinea). A different smut fungus, collected in Uganda, is:

Sporisorium rhytachnes-rottboellioidis Vánky, **sp. nov.**

Typus in matrice *Rhytachne rottboellioides* Desv. (det. M. Namaganda, MHU), Uganda, Masaka Distr., 13 km E Masaka, on Bukakata road, 00°18'19" S, 31°55'52" E, alt. cca. 1140 m.s.m., 17.II.2002, leg. C., T. & K. Vánky. Holotypus in Herbario Ustil. Vánky, HUV 19994, isotypi in MHU, BPI, IMI et K.

Sori in ovariis, ovoidei vel cylindrici, 0,5–1 x 3–5 mm, involucris floralibus partim obtecti, primum peridio cinerescentibrunneo cooperti, quo irregulariter rupto massam atrobrunneam, pulveream glomerulorum sporarum laxorum sporarumque et columellam centralem flagelliformem ostendentes. *Glomeruli sporarum* globoidei, ellipsoidales, elongati vel irregulares, 20–45 x 25–60 µm, rubrobrunnei, e sporis 15 usque pluries decem, leviter separabilibus compositi. *Sporae* forma et magnitudine variae, rotundatae usque elongatae, plerumque subpolyedrice irregulares, 6,5–9 x 7.5–13,5 µm, flavidobrunneae; pariete parum inaequali, 0,5–1 µm crasso, a conspicue levi usque leniter, dense punctato; imago obliqua sporarum levis. *Cellulae steriles* non observatae.

Sori (Fig. 41) in ovaries, ovoid or cylindrical, 0.5–1 x 3–5 mm, partly hidden by the floral envelopes, first covered by a greyish-brown peridium which ruptures irregularly disclosing the dark brown, powdery mass of loose spore balls and spores, and a flagelliform, central columella. *Spore balls* (Figs. 45, 46) globoid, ellipsoidal, elongated or irregular, 20–45 x 25–60 µm, reddish-brown, composed of 15 to tens of easily separating spores. *Spores* (Figs. 45, 46) variable in shape and size, rounded to elongated, usually subpolyhedrally irregular, 6.5–9 x 7.5–13.5 µm, yellowish-brown; wall slightly uneven, 0.5–1 µm thick, from apparently smooth to finely, densely punctate; spore profile smooth. *Sterile cells* not seen.

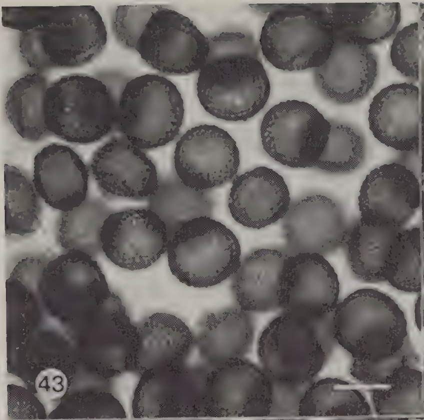
On *Rhytachne rottboellioides* Desv.; C. Africa (Uganda).

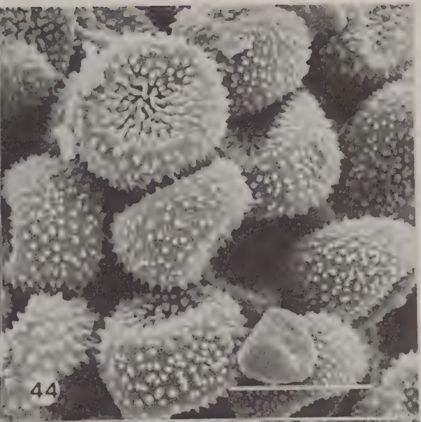
Figs. 43, 44. Spores and sterile cells of *Macalpinomyces ugandensis* Vánky on *Sorghastrum stipoides* (Kunth) Nash, in LM and in SEM (type).

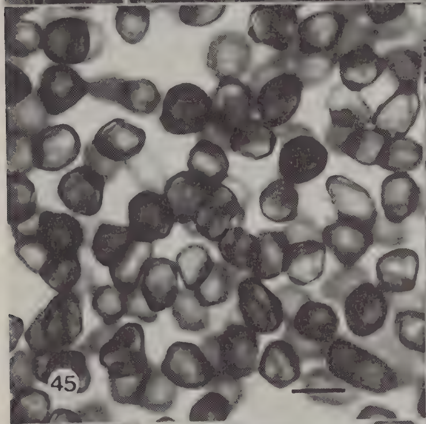
Figs. 45, 46. Spore balls and spores of *Sporisorium rhytachnes-rottboellioidis* Vánky on *Rhytachne rottboellioides* Desv., in LM and in SEM (type).

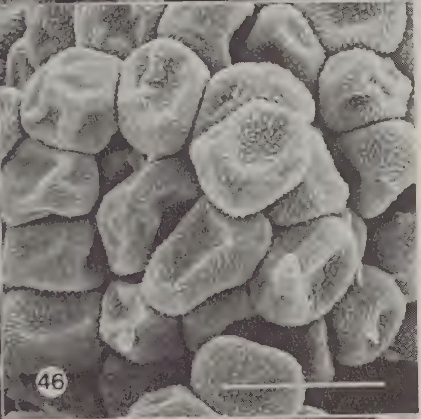
Figs. 47, 48. Spore balls and spores of *Sporisorium eriochrysis* Vánky on *Eriochrysis brachypogon* (Stapf) Stapf, in LM and in SEM (type).

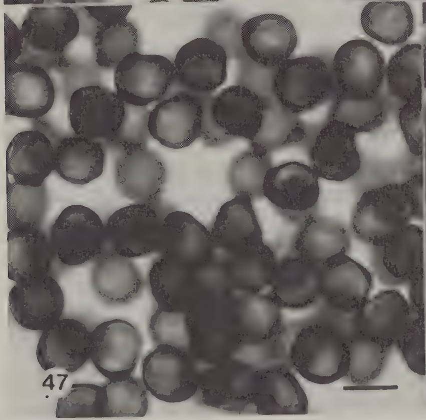
Bars = 10 µm.

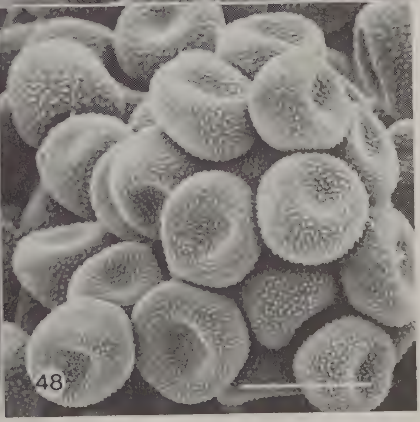

43


44


45


46


47


48

Key to the smut fungi of *Rhytachne*

1. Sori on the leaves. Spore wall 2–8 µm thick............ ***Tolyposporella rhytachnes***
– Sori not on the leaves. Spore wall 0.5–1.5 µm thick..2
2. Sori in the whole inflorescence. Spores 11–15(–16) µm long, dimorphic, outer spores prominently verrucose-echinulate .... ***Sporisorium rhytachnes***
– Sori in the ovaries. Spores 7.5–13.5 µm long, not dimorphic, finely, densely punctate .... ***Sporisorium rhytachnes-rottboellioidis***

A SMUT FUNGUS ON *ERIOCHRYSIS* (GRAMINEAE)

Eriochrysis P. Beauv, in the subfam. Panicoideae, tribe Andropogoneae, subtribe Saccharinae, is a small, homogeneous genus of 7 species in Africa, tropical America and one species in India. It is allied to *Saccharum* (Clayton & Renvoize, 1986:331). No smut fungus has been previously reported on *Eriochrysis*.

Sporisorium eriochrysis Vánky, sp. nov.

Typus in matrice *Eriochrysis brachypogon* (Stapf) Stapf (det. M. Namaganda, MHU), Uganda, Masaka Distr., 20 km E Masaka, Lake Nabugabo pr. Bale, 00°20'22" S, 31°52'25" E, alt. cca. 1130 m.s.m., 26.II.2002, leg. C., T. & K. Vánky. Holotypus in Herbario Ustil. Vánky, HUV 19995, isotypi in MHU, BPI, K et in Vánky, Ust. exs. no. 1178.

Sori in spiculis et sessilibus et pedicellatis, organa floralia intima destruentes, ovoidei usque cylindrici, 0,7–1 x 3–6 mm, glumis partim obtecti, primum peridio flavidobrunneo cooperti, quo irregulariter rupto massam nigrobrunneam, semiagglutinatam usque pulveream glomerulorum sporarum laxorum sporarumque, columellam centralem flagelliformem circumdantium ostendentes. *Glomeruli sporarum* globosi, elongati usque irregulares, 30–70 x 40–80 µm, atro-flavidobrunnei usque subopaci, e sporis pluribus decem, leviter separabilibus compositi. *Sporae* globosae, subglobosae, ovoideae, ellipsoideae usque parum irregulares, raro elongatae, 9–11 x 10–12(–13) µm, flavidobrunneae; pariete inaequaliter crasso, 0,5–1(–1,5) µm, leniter, dense punctato-verruculoso; imago obliqua sporarum levis. *Cellulae steriles* non observatae.

Sori (Fig. 42) in both sessile and pedicelled spikelets, destroying the innermost floral organs, ovoid to cylindrical, 0.7–1 x 3–6 mm, partly hidden by the glumes, first covered by a yellowish-brown peridium which splits irregularly disclosing the blackish-brown, semiagglutinated to powdery mass of loose spore balls and spores, surrounding a flagelliform, central columella. *Spore balls* (Figs. 47, 48) globose, elongate to irregular, 30–70 x 40–80 µm, dark yellowish-brown to subopaque, composed of tens of spores which separate easily. *Spores* (Figs. 47, 49) globose, subglobose, ovoid, ellipsoidal to slightly irregular, rarely elongated, 9–11 x 10–12(–13) µm, yellowish-brown; wall unevenly thick, 0.5–1(–1.5) µm, finely, densely punctate-verruculose; spore profile smooth. *Sterile cells* not seen.

On *Eriochrysis brachypogon* (Stapf) Stapf; C. Africa (Uganda).

NEW COMBINATIONS

Macalpinomyces pretoriensis (Pole-Evans) Vánky, comb. nov.

Basionym: *Ustilago pretoriensis* Pole-Evans, in Sydow, H. & P., Ann. Mycol. 12:263, 1914. — *Sphacelotheca pretoriensis* (Pole-Evans) Zundel, 1938:301. — *Sporisorium pretoriense* (Pole-Evans) Vánky, 1998, nom. herb. — Type on *Panicum helopus* Trin. var. *glabrescens* (K. Schum.) Stapf (*Urochloa panicoides* Beauv.), South Africa, Transvaal, Pretoria, 20.III.1914, A.O.D. Mogg, PREM 7408. Isotype in HUV 18004!

Sori in some flowers of an inflorescence transforming the inner floral organs into one or several, horn-shaped, cylindrical or twisted bodies, 0.3–2.5 x 5–40 mm, first covered by a greyish-brown peridium which shreds into numerous, long, filaments disclosing the semiagglutinated to powdery mass of spores and sterile cells. *Spores* single when mature, globose, subglobose to broadly ellipsoidal, 9–12.5 x 9.5–13 µm long, yellowish-brown; wall even, c. 1 µm thick, prominently, moderately densely echinulate, spore profile serrulate. *Sterile cells* in irregular groups, single cells subglobose, ovoid, ellipsoidal or subpolyhedrally slightly irregular, smaller than the spores, 5–8 x 6–11 µm, hyaline; wall c. 0.5 µm thick, smooth, content homogeneous.

On *Panicum maximum* Jacq., *Urochloa panicoides* Beauv. (*U. helopus* (Trin.) Stapf, *Panicum helopus* Trin. var. *glabrescens* (K. Schum.) Stapf), *U. trichopus* (Hohst.) Stapf; C. & S. Africa (South Africa, Zambia, Zimbabwe).

Savile, 1953:664, described *Thecaphora apicis*, forming spore balls in the ovaries of *Carex pyrenaica* Wahlenb. Species of *Thecaphora* are restricted to dicotyledonous host plants. Those on Cyperaceae belong to the genus *Moreaua*

Moreaua apicis (Savile) Vánky, comb. nov.

Basionym: *Thecaphora apicis* Savile, Canad. J. Bot. 31:664, 1953. — Type on *Carex pyrenaica* Wahlenb., Canada, British Columbia, 15 miles NW of Keremeos, Apex Mountain, 6.IX.1951, H.A. Senn, C. Frankton & J.M. Gillett, DAOM 34034!

Sori destroying the nutlets, globoid, c. 1 mm in diameter, blackish-brown, first covered by a thin layer of host epidermis which early dehisces exposing the powdery mass of spore balls. *Spore balls* globose, ellipsoidal to irregular, 9–25 x 12–30 µm, yellowish-brown, composed of (–1)2–20 spores. *Spores* variable in shape and size, globoid, ellipsoidal to irregular, with slightly flattened sides, sometimes subcuneiform, 5.5–9.5 x 6.5–14.5 µm, yellowish-brown; wall even, 0.5–0.8 µm thick (in lactophenol, with time, much swollen, up to 3 µm), free surface rough, in SEM finely, densely verruculose.

On Cyperaceae: *Carex pyrenaica* Wahlenb.; Europe (Mt. Pyrénées), N. America (Canada).

Viennot-Bourgin, 1958:170, described *Sphacelotheca elymandrae* in the ovaries of *Elymandra androphila*. Species of *Sphacelotheca* are restricted to members of the Polygonaceae family. Study of the type of *S. elymandrae* showed that it belongs to the genus *Macalpinomyces*.

Macalpinomyces elymandrae (Viennot-Bourgin) Vánky, **comb. nov.**

Basionym: *Sphacelotheca elymandrae* Viennot-Bourgin, Rev. Pathol. Vég. Entomol. Agric. France 37:170, 1958. — Type on *Elymandra androphila* Stapf, Guinea, near Boké, XI.1956, leg. Jacques-Félix. Holotype in Herb. Viennot-Bourgin, PC, isotype in HUV 15801!

Sori in some ovaries of an inflorescence, swollen, ovoid, ellipsoidal, often apically narrowing into an acute tip, 8–12 x 10–15 mm, covered by a thin, yellowish-brown peridium of host and fungal origin which ruptures at maturity disclosing the dark brown, powdery mass of spores intermixed with groups of sterile cells. No conspicuous columella only a short prolongation of the floral axis mixed with fungal elements. *Spores* yellowish-brown, globose, subglobose to ellipsoidal, 9.5–13.5 x 10.5–15 μm, including the 1–1.5 μm high, conical spines. *Sterile cells* in irregular groups, single cells variable in shape and size, globose, ellipsoidal to irregular, 5–16 μm long, subhyaline, collapsed in old specimen; wall thin (c. 0.5 μm), even, smooth.

On Gramineae: *Elymandra androphila* Stapf; W. Africa (Guinea). Known only from the type collection.

Sporisorium argentinum (Hirschh.) Vánky, **comb. nov.**

Basionym: *Crozalsiella argentina* Hirschhorn, Notas Mus. La Plata, Bot. 5:236, 1940. — *Sphacelotheca argentina* (Hirschh.) Zundel, 1953:81. — Type on *Panicum demissum* Trin. (= *P. sabulosum* Lamark), Argentina, Buenos Aires, Hudson, Villa Elisa, X.1924, J.B. Marchionatto, LPS 3649!

Sori at the base of the last upper internode, probably comprising the young inflorescence, globose or ovoid, 3–5 x 3–5 mm, with a long, apiculate host plant remnant on its distal part, covered by host tissues and a brown peridium which ruptures irregularly disclosing the dark brown, semiagglutinated mass of spores and sterile cells surrounding several short columellae. *Spores* single when mature, subglobose, broadly ellipsoidal or often kidney-shaped, 5.5–9.5 x 8–10.5 μm, yellowish-brown; wall evenly thick (c. 0.5 μm), finely, densely punctate-verruculose, spore profile smooth. *Sterile cells* 8–15 μm long, in small groups, collapsed in old specimen, hyaline; wall thin, c. 0.5 μm, smooth.

On Gramineae: *Panicum sabulosum* Lamarck (*P. demissum* Trin.), and *P. urvilleanum* Kunth; Argentina, Uruguay.

Sporisorium anadelphiae (Viennot-Bourgin) Vánky, **comb. nov.**

Basionym: *Sorosporium anadelphiae* Viennot-Bourgin, Bull. Soc. Bot. France 104:266, 1957. — Type on *Anadelphia pumila* Jacques-Félix, Guinée francaise [= Guinea], Foulaya near Kindia, I.1957, G. Viennot-Bourgin. Holotype in PC, isotype in HUV 15800!

Sori in some spikelets of an inflorescence, destroying the innermost floral organs, long cylindrical, 0.5–1.5 x 2–14 mm, covered by a thick, yellowish-brown peridium which ruptures longitudinally from its apex into 2–3 bands, disclosing the blackish-brown, granular-powdery mass of spore balls surrounding a stout central columella. *Spore balls* variable in shape and size, globoid, ellipsoidal, elongated to irregular, subpolyangular, 30–125 x 40–160 µm, dark reddish-brown, composed of tens to hundreds of spores which separate by pressure. *Spores* dimorphic. Outer spores globoid, ellipsoidal to subpolyhedrally irregular, 9.5–13(–15) x 10.5–16 µm, dark reddish-brown; wall uneven, 0.8–2.5 µm thick, densely, prominently verrucose on the free surface, warts up to 1 µm high, spore profile serrulate. Inner spores subglobose, ellipsoidal, usually rounded, subpolyhedrally irregular, 7–11.5 x 8–11(–12) µm, pale yellowish-brown; wall even, c. 0.5 µm thick, minutely, densely punctate or apparently smooth.

On Gramineae: *Anadelphia pumila* Jacques-Félix, Africa. Known only from the type locality.

Sporisorium panici-carthaginense (Spegazzini) Vánky, **comb. nov.**

Basionym: *Ustilago panici-carthaginenis* Spegazzini, Anales Mus. Nac. Buenos Aires, Ser. 2, 6:207, 1899 (as "*panici-carthagenenis*"). — *Sorosporium panici-carthaginense* (Speg.) Zundel, 1953:68 (as "*panici-carthaginenis*"). — Type on *Panicum carthaginense* Arechav. (= *P. fultum* Hack.), Uruguay, Cerro de Montevideo, summer 1882-91, leg. J. Arechavaleta & C. Spegazzini, LPS (?)3038!; topotype on *P. fultum* Hack., VI.1927, G. Herter, HUV 5216!

Sori destroying the whole inflorescence and also the basal part of the terminal leaf sheaths, swollen, globoid, 2–5 mm in diameter, with an acute tip bearing a more or less well-developed leaf blade, compact, covered by a peridium of fungal and host tissues which ruptures usually transversally at its base disclosing the powdery, brown mass of spore balls, spores, sterile cells and several, short, stout, bent columellae. *Spore balls* composed of many, easily separating spores. *Spores* single when mature, variable in shape and size, ovoid, ellipsoidal, irregular, often with a flattened side, sometimes elongated into a subacute tip, (6.5–)7–9.5(–11) x 8.5–13 µm, yellowish-brown; wall even, c. 0.5 µm thick, finely, densely punctate to finely verrucose-echinulate, spore profile smooth to finely wavy. *Sterile cells* in irregular groups, single cells subglobose, ellipsoidal to irregular, 8–15 µm long, hyaline; wall 0.5–1 µm thick, smooth, collapsed in old specimens.

On Gramineae: *Panicum fultum* Hack. (*P. carthaginense* Arechav., not Swartz, *P. fasciculatum* Swartz var. *carthaginense* Arechav.); Uruguay.

Sporisorium parodii (Hirschh.) Vánky, **comb. nov.**

Basionym: *Ustilago parodii* Hirschhorn, Darwiniana 3:401, 1939 — Type on *Muhlenbergia diffusa* Willd. (= *M. schreberi* Gmel.), Argentina, La Plata, Bosque, X.1936, L. R. Parodi, Herb. Hirschhorn 35, isotype in LPS 3055!

Sori comprising the distal part of the shoots (inflorescence? and some terminal leaves), long cylindrical, 3–4 x 10–12 mm, first covered by a whitish-brown peridium with the tips of 1–2 leaves. The peridium ruptures longitudinally disclosing the brown, granular to powdery mass of spores surrounding 8–12 filiform columellae of the length of the sorus. *Spores* single when mature, globose, subglobose, ellipsoidal to slightly irregular, 8–12 x 8–15 µm, globose spores 8–12 µm in diameter, yellowish-brown; wall even, 1–2 µm thick, finely, densely verruculose, spore profile wavy to finely serrulate. *Sterile cells* not seen. *Spore germination* (Hirschhorn, 1939:405 & Fig. 4c) results in 4-celled basidia producing mycelia and also a basidiospore(?).

On Gramineae: *Muhlenbergia schreberi* Gmel. (*M. diffusa* Willd.); Argentina.

This fungus differs from all 18 smut fungi described on *Muhlenbergia*. Unfortunately, the host plant identity could not be verified from the material at hand.

Urelytrum Hack., in the subtribe Rottboelliinae, tribe Andropogoneae, has 7 species in tropical Africa (Clayton & Renvoize, 1986:361). Only one smut fungus was so far described from it:

Sporisorium urelytri (L. Ling) Vánky, **comb. nov.**

Basionym: *Sorosporium urelytri* L. Ling, *Sydowia* 7:156, 1953c. — Type on *Urelytrum giganteum* Pilger, Sudan, Equatoria Prov., Meridi-Yei boundary, near Olo River, 4.V.1938, J.G. Myers 9003. Holotype in IMI 25276! Paratypes on *Urelytrum giganteum*, Congo, à la Grelo section, VII.1931, P. Quarré 2593, IMI 36152, BPI 180815; on *Urelytrum stapfianum* C.E. Hubb. (= *U. digitatum* K. Schum.), Angola, no date, coll. Gossweiler 9518, IMI 25277; *U. stapfianum* (=*U. digitatum*), Angola, Lalange Plateau, Kela, 3.I.1931, Gossweiler, IMI 36153.

Sori destroying the inner floral organs of both sessile and pedicelled spikelets, long ellipsoidal or cylindrical, with one or several, short, acute tips, c. 1 x 3–6 mm, partially exposed between the glumes, first covered by a thick, pale brown peridium which dehisces irregularly from its apex, disclosing the dark brown, semiagglutinated to powdery mass of spore balls surrounding a stout, central columella with short apical branches. *Spore balls* subglobose, ellipsoidal, elongated to usually irregular, 40–80 x 45–130 µm, dark reddish-brown, composed of tens of spores which separate by pressure. *Spores* subglobose, ellipsoidal, usually rounded subpolyhedrally irregular, 9–14 x 10–15(–16) µm, medium yellowish-brown; wall even, 0.5–0.8 µm thick, finely, densely punctate-verruculose, spore profile smooth.

On Gramineae: *Urelytrum giganteum* Pilger, *U. digitatum* K. Schum. (*U. stapfianum* C.E. Hubb.), Africa (Angola, Congo, Sudan).

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THREE INTERESTING THERMOPHILIC TAXA OF GYMNOPUS (BASIDIOMYCETES, TRICHOLOMATACEAE): G. PUBIPES SP. NOV., G. PUBIPES VAR. PALLIDOPILEATUS VAR. NOV. AND G. DRYOPHILUS VAR. LANIPES COMB. NOV.

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Abstract Three *Gymnopus*-taxa (Basidiomycetes, Tricholomataceae) were studied. One new species, *G. pubipes*, is described for a thermophilic fungus usually erroneously identified as *G. benoistii*. This study is based on studies of the original description of the latter species and recently collected material from Spain. A macroscopically different but microscopically identical fungus recorded in the Czech Republic, Romania, Slovakia and Sweden is described as *G. pubipes* var. *pallidopileatus*. A new combination, *G. dryophilus* var. *lanipes*. is also proposed and its neotype from a recent collection from Spain is designated here.

Key words: Agaricales, new taxa, type-revision, taxonomy, nomenclature.

Introduction

During the past years, we collected three taxa of the genus *Gymnopus* (Pers.) Roussel in Mediterranean and Central-European thermophilic ecosystems. They have been named *Gymnopus* (or *Collybia*) *benoistii* or *G.* (*C.*) *dryophilus* var. *lanipes*, respectively, in most recent mycological literature (MALENÇON & BERTAULT 1975;

MORENO ET AL. 1990; ORTEGA ET AL. 1991; ANTONÍN & NOORDELOOS 1997; BON 1999; HAUSKNECHT & KRISAI-GREILHUBER 2000). To clarify the taxonomic position of these taxa, we made a comparative study of collections from different European countries, as well as of the type material.

The type material of *C. benoistii* Boud. is apparently not preserved, at least not in Boudier's herbarium deposited in the herbarium of the Museum of Natural History in Paris (PC), so this species has to be interpreted only according to the original description (BOUDIER 1900). Most fungi identified in recent years as *C. benoistii* (see references above) agree only partially with Boudier's species, and his original diagnosis does not include data on some essential characters in *Gymnopus* taxonomy, e.g. the type of pileipellis or its reaction with KOH. Regarding those circumstances, we decided to describe the new species *Gymnopus pubipes*, which includes the concept of *C. benoistii* of many European mycologists.

The type collection of *Marasmius dryophilus* var. *lanipes* Malençon et Bertault preserved in the herbarium in Montpellier (MPU) was studied and compared with recent Italian and Spanish samples. Unfortunately, the holotype does not correspond to the original diagnosis (MALENÇON & BERTAULT 1975: 362). Therefore, a neotype was designated from Spanish material, as no paratypic collections exist in Montpellier Herbarium.

Material and methods

Gymnopus pubipes and *G. dryophilus* var. *lanipes* have a wide distribution in the Mediterranean countries (southern Europe and northern Africa) and one variety of the first one (see below) also in thermophilous associations (oak and hornbeam-oak stands) in Central and Northern Europe (Austria, Czech Republic, Romania, Slovakia, Sweden). Most Spanish localities of the latter species were recorded in Mediterranean ecosystems in Andalucía (Granada, Málaga) and Castilla-La Mancha (Guadalajara), whereas the material of *Gymnopus dryophilus* var. *lanipes* comes from southern Spain (Andalucía, provinces of Granada, Málaga and Sevilla), as well as from Italy (material previously studied and published by LONATI 1986).

Microscopic slides of dried material were prepared with 5% NH_4OH, Melzer´s reagent and Congo Red in 10% ammonia. Macroscopic reactions on the pileus of the samples were tested with a 10% KOH solution. Drawings were made with the aid of Zeiss (A.O. and F.E.-R.) and Olympus (V.A.) drawing tubes under an oil-immersion lens. Colours of basidiomata were compared with KORNERUP & WANSCHER (1973). Spore measurements are given according to HEINEMANN & RAMMELOO (1985). Herbarium acronyms are according to HOLMGREN ET AL. (1990). Abbreviations of authors of fungal names follow KIRK & ANSELL (1992).

Apart from other references cited in the text, we have followed the general taxonomic criteria proposed in the European *Collybia* s. l. monograph by ANTONÍN & NOORDELOOS (1997), and the essential treatise for Mediterranean agarics by MALENÇON & BERTAULT (1975).

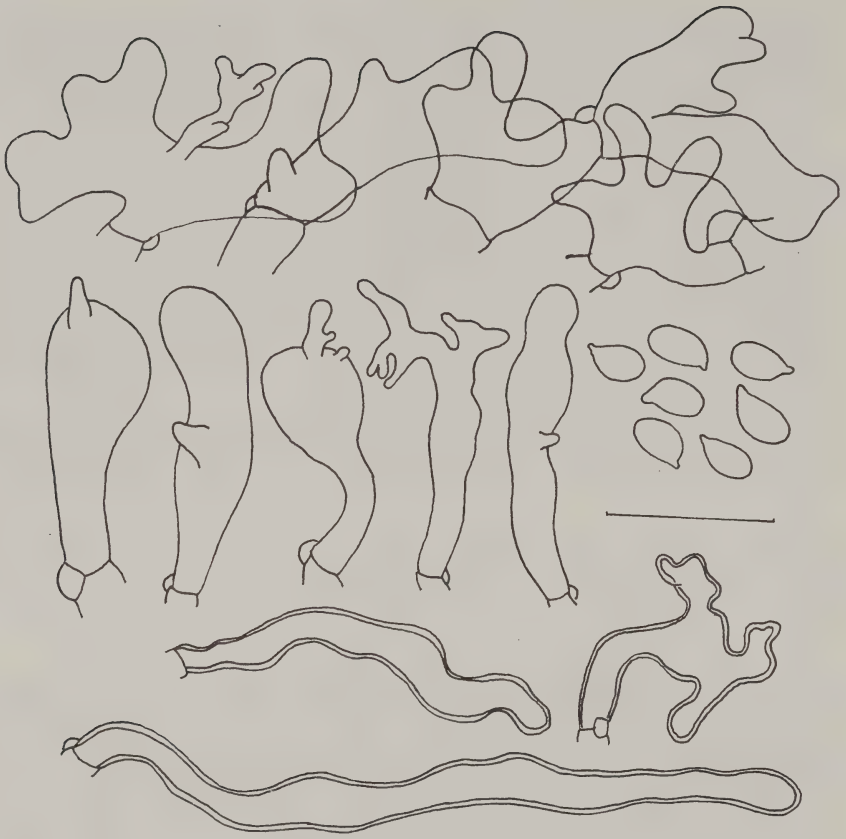
Gymnopus pubipes **Antonín, A. Ortega et Esteve-Rav., sp. nov.**

Misapplied names: *Collybia benoistii* Boud., Bull. Soc. mycol. France 16: 102, 1900; *Gymnopus benoistii* (Boud.) Antonín & Noordel., Mycotaxon 63: 363. 1997 s. auct. p. part., non s. Boud.

Pileo 10-40 mm lato, hemisphaerico vel convexo, dein applanato, centro applanato vel depresso, obscure brunneo vel purpureo-brunneo, pallescente pallide brunneo vel cremeo. Lamellis adnexis vel emarginatis, cremeis vel ochraceis. Stipite 20-60 × 2-7 mm, cylindraceo, cum pileo concolore, tomentoso. Sporis (5.0-)5.5-8.0 × 2.5-4.0 μm, oblongis-ellipsoideis, sublacrimoideis. Cheilocystidiis 20-40 × 5.0-20 μm, clavatis, cylindraceis, subcapitatis, fusiformibus, frequenter irregularibus. Pileipellis e cellulis similibus sicut in Gymnopus dryophilus constructa. Caulocystidiis cylindraceis, clavatis, obtusis, 3.0-8.0 μm latis.
Holotypus: Hispania, Huétor-Santillán, area protecta Sierra de Huétor, sub *Quercus ilex* subsp. *ballota*, 18. X. 1977 leg. G. Malençon, X. Llimona & A. Ortega (holotypus in herbario GDA 10332 asservatur, isotypi in herbaria AH 26979 et BRNM 670685 asservantur).

Selected descriptions and iconography: Malençon & Bertault (1975: 385-387, fig. 81, pl. 15, as *Marasmius terginus* f. *benoistii*); Moreno et al. (1990: 118-120, as *Collybia benoistii*); Antonín & Noordeloos (1997: 97-98, fig. 29, pl. 24, as *Gymnopus benoistii* p. p.).

Pileus 10-40 mm, hemisphaerical to convex, expanding to applanate or slightly depressed with age, hardly or not umbonate, with involute then straight or slightly reflexed margin, hygrophanous and striate at the margin when moist, chestnut-brown (9E8) or purplish-brown (10E8) when moist, pallescent to pallid brown (6C8) or cream (5A3-4) on drying, smooth to slightly radially rugulose. Lamellae rather distant, L = 20-25, l = 1-3, deeply emarginate to adnexed, subventricose, pale cream (5A3-4) to buff (6C6-8), often showing a pale reddish reflection, with entire to slightly sinuose edge. Stipe 20-60 × 2-7 mm, cylindrical, often compressed, tenacious, whitish to pale cream when young, becoming concolorous with pileus with age, entirely pubescent, densely tomentose towards the base, with fine white to cream coloured hairs; white rhizoids often present at the base. Context concolorous with surface. Smell and taste indistinct.
Spores (5.0-)5.5-8.0 × 2.5-4.0 μm, X = 6.5 × 3.4 μm, E = 1.6-2.3, Q = 1.9, oblong-ellipsoid to sublacrymoid, smooth, hyaline, non-amyloid. Basidia 18-25 × 5.0-7.5 μm, 4-spored, clavate. Basidioles 12-30 × 3.0-8.0 μm, cylindrical to clavate. Lamella edge sterile. Cheilocystidia 20-40 × 5.0-20 μm, very variable in form, mostly clavate to subcapitate, cylindrical to fusiform, sometimes irregular, lobate or with several wide projections. Pileipellis with typical dryophila-structure, composed by cylindrical to inflated up to 15 μm wide hyphae, with lobate to coralloid terminal elements up to 20 μm wide, showing incrusting pigment. Stipitipellis a cutis, of cylindrical, parallel, slightly thick-walled, up to 5.0 μm wide hyphae. Caulocystidia very numerous, 3.0-8.0 μm wide, polymorphic, sinuose, usually cylindrical to clavate, with obtuse apex, slightly thick-walled, sometimes septate, sometimes with obtuse projections at the apex. Clamp-connections present in all tissues. Chemical reactions: KOH reaction on pileus green.



Gymnopus pubipes (holotype): pileipellis, cheilocystidia, spores and caulocystidia. Scale bar = 20 µm.

Ecology: Often gregarious, saprotrophic on vegetal debris (leaves, branches), especially of *Quercus* or *Pinus*, or in mixed stands, sometimes under *Juniperus*, in thermophilous forests on calcareous soils.
Distribution and phenology: Widespread in southern Europe and northern Africa. Autumn to early winter in the Mediterranean region.

Material studied: SPAIN: Granada: Huétor-Santillán, Parque natural de la Sierra de Huétor, road to campamento de la Alfaguara, under *Quercus ilex* subsp. *ballota*, 18 Oct. 1977 leg. G. Malençon, X. Llimona and A. Ortega (holotype GDA 10332, isotypes AH 26979 and BRNM 670685); Baza, Parque natural de la sierra de Baza, pinar de Cala, under *Juniperus communis*, 3 Nov. 1992 leg. A. Ortega and D. Sousa (GDA 36231); Lanteira, Parque natural de Sierra Nevada, under *Salix atrocinerea* in *Pinus* forest, 13 Nov. 1999 leg. A. Capilla, F. Esteve-Raventós and A. Ortega (GDA 44742); Juviles, Parque natural de Sierra Nevada, under *Pinus sylvestris*, 28 Oct. 2000 leg. L. Alcoba and A. Ortega (GDA 44743); Guadalajara: Albalate de Zorita, under *Quercus ilex* subsp. *ballota*, 15 Oct. 1999 leg. V. Bandala, F. Esteve-Raventós, L. Montoya and M. Villarreal (AH 26931).

The fungus described above represents a "Mediterranean type" of this species. A fungus with totally identical microscopic features grows in thermophilous stands of Central Europe and southern parts of northern Europe. However, it differs by macroscopic features, especially the colour of carpophores. Therefore, we decided to describe it as a new variety of *G. pubipes*.

Gymnopus pubipes **var.** ***pallidopileatus*** **Antonín, A. Ortega et Esteve-Rav., var. nov.**

A varietate typica carpophoris parvis et pallide coloratis differt.
Holotypus: Cechia, Moravia, Ochoz prope Brno, area protecta Hornek, ad folia deiecta *Quercus*, 20. VI. 2001 leg. A. Vágner (holotypus in herbario BRNM 667673 asservatur).

Selected descriptions and iconography: Antonín & Noordeloos (1997: 97-98, fig. 29, pl. 24, as *Gymnopus benoistii* p. p.).

It differs from the typical variety in having a smaller, 15-30 mm broad pileus, coloured brown (6C5) at centre, paler (pale cream, beige or whitish) towards margin, paler lamellae (paler than 4A2) and paler stipe, almost whitish above and brown (6C4-5) towards base. Its microscopic features fully agree with var. *pubipes*.
Ecology: It grows on fallen *Quercus*-leaves, rarely on leaves of other broad-leaved trees (*Acer campestre, Carpinus*).
Distribution and phenology: It is known from Central Europe (Austria, Czech Republic, Romania and Slovakia) and southern Sweden. It has been recorded in spring and summer (May to August).

Material studied: CZECH REPUBLIC: Hlásná Třebáň, 27 May 1945 leg. V. Vacek (PRM); Ochoz near Brno, Údolí Říčky nature reserve, Lysá hora, on fallen leaves and twigs in a *Carpinus-Quercus* stand, 19 July 2000 leg. V. Antonín and A. Vágner (Antonín 00.25, BRNM 652808); Ochoz near Brno, Hornek nature reserve, on fallen leaves of *Carpinus, Quercus* and *Acer campestre*, 29 July 2000 leg. A. Vágner (BRNM 652989) and 20 June 2001 leg. A. Vágner (BRNM 667673, holotype); Moravský Krumlov, Krumlovsko-rokytenské slepence nature reserve, on fallen leaves of *Quercus*, 23 Aug. 2001 leg. V. Antonín and Z. Bieberová (Antonín 01.210, BRNM 666476); Kobylí na Mor., Ochozy, on *Quercus* leaves, 12 June 1994 leg. V. Antonín 94.53 (BRNM 599017); Valtice, Rendezvous, in *Quercus* leaves, 18 June 1993 leg. H. Deckerová (Antonín 93.30 and 31, BRNM 576463 and 576464). **ROMANIA:** Bucureşti, destination Piteşti, 14 July 1976 leg. J. Kubička (PRM). **SLOVAKIA:** Nitra, Zobor, 3 June 1972 leg. L. Opold (BRA). **SWEDEN:** Västergötland, Lötene, Medelplana, Munkängarnas naturreservat, on *Quercus* leaves, on limestone, 29 July 1985 leg. L. & A. Stridvall 83/003 (herb. Stridvall, L, BRNM 603950).

Gymnopus pubipes is characterised by a more or less uniformly reddish-brown pileus (var. *pubipes*) or a pileus brown at centre and beige, pale cream to whitish towards margin (var. *pallidopileatus*), a strongly pubescent to velutinous stipe, a dryophila-type pileipellis, clavate to subcapitate, cylindrical to fusiform, sometimes irregular cheilocystidia and a green reaction of the pileus surface and pileipellis with KOH. *Gymnopus fuscopurpureus* (Pers.: Fr.) Antonín et al. (= *Collybia obscura* J. Favre) represents a close taxon. It can sometimes be found in the same habitats and shows the same green reaction on the pileus with KOH. The species differ in the colours of the basidiomata, stipe covering and size and shape of cheilocystidia. *Gymnopus pubipes* belongs to the subsect. *Alkalivirentes* Antonín et Noordel. having a dryophila-type pileipellis and green chemical reaction on the pileus (ANTONÍN & NOORDELOOS loc. cit.).

As previously stated in the introductory chapter, *G. pubipes* has regularly been identified as *Collybia* (or *Gymnopus*) *benoistii* (MORENO ET AL. 1990; ANTONÍN & NOORDELOOS 1997) or *Marasmius terginus* f. *benoistii* (Boud.) Malençon et Bertault (MALENÇON & BERTAULT 1975). All these authors indicate a spore size ranging (5.5-)6-9(-11) × 3-4(-5) µm, although information about the KOH reaction on the pileus is lacking or said to be absent (ANTONÍN & NOORDELOOS loc. cit.). The most recent record of this fungus was published by HAUSKNECHT & KRISAI-GREILHUBER (2000) with a sporal range of 6-8 × 3-3.5 µm, which agrees with our observations (it represents var. *pallidopileatus*). BON's (1999) concept of *C. benoistii* is rather similar to that of BOUDIER (1900) because he refers to a species with much larger spores [(8-)9-10(-11) × (3.5-)4-5(-6) µm].

MALENÇON & BERTAULT (loc. cit.) and ORTEGA ET AL. (1991) subordinated *C. benoistii* to *Marasmius terginus* (Fr.) Fr. or *Collybia tergina* (Fr.) S. Lundell as a form or variety, respectively. However, the pileipellis of the *tergina* group is rather different from our former concept of *C. benoistii* (= *Gymnopus pubipes*), as already remarked by ANTONÍN & NOORDELOOS (loc. cit.).

Unfortunately, the absence of type material in Boudier's herbarium does not allow to have a correct picture of what *C. benoistii* might represent – mainly regarding the reaction of the pileus with KOH, the type of pileipellis and the spore size, which are very important characters in *Gymnopus* taxonomy. Boudier's species could also be related to some other taxon of *Gymnopus* sect. *Vestipedes* (Fr.) Antonín et al. or sect. *Levipedes* (Fr.) Halling and, in our opinion, should be best regarded as a *nomen dubium*.

Gymnopus dryophilus var. _lanipes_ (Malençon et Bertault) A. Ortega, Antonín et Esteve-Rav., comb. nov.

Basionym: *Marasmius dryophilus* var. *lanipes* Malençon et Bertault, Trav. Inst. Sci. Cherif. Fac. Sci. Rabat 33 (Fl. Champ. Supér. Maroc 2): 362, 1975.

= *Collybia dryophila* var. *lanipes* (Malençon et Bertault) A. Ortega et Vizoso, Doc. Mycol. 21(82): 23, 1991.

Neotype (selected here): Spain, Málaga, Road Málaga-Colmenar, venta de Garvey, in *Pinus* forest, 10 Nov. 2000, leg. L. Alcoba and A. Ortega, GDA 44739 (isoneotypes AH 26980 and BRNM 670686).

Selected descriptions and iconography: Malençon & Bertault (1975: 361-364, fig. 77, as *Marasmius dryophilus* var. *lanipes*); Lonati (1986: 15-17, as *Marasmius dryophilus* var. *lanipes*).

Pileus 12-45 mm, convex to plano-convex, later applanate or slightly depressed around the centre, with inflexed, then straight margin, hygrophanous, translucently striate at the margin (sometimes reaching half of the pileus) when moist, entirely orange-brown to ochraceous-brown when humid (7-8E8), strongly pallescent on drying, becoming yellow-ochraceous to cream (5A3-4), smooth, glabrous. Lamellae moderately crowded, adnate to emarginate, narrow, segmentiform or slightly ventricose, whitish (5A1), with entire to subentire concolorous edge. Stipe 30-65 × 3-8.5 mm, cylindrical to broadened towards the base, subconcolorous to paler than the pileus, brown-orange to ochraceous-yellow, whitish at the apex, surface finely pubescent, especially near the base, never tomentose, whitish rhizoids present at the base. Context concolorous with surface. Smell and taste indistinct.

Spores (3.8-)4.5-7.2(-8.0) × 2.2-3.5 μm, Xm = 5.2 × 2.8 μm, E = 1.6-2.3, Q = 1.85, oblong-ellipsoid to (sub-)lacrimoid, smooth, hyaline, non-amyloid. Basidia 23-31 × 5.0-6.0 μm, 4-spored, clavate. Basidioles 15-32 × 2.5-7.0 μm, cylindrical to clavate, less frequently subfusoid. Cheilocystidia rather inconspicuous, 18-25 × 4.0-7.0 μm, cylindrical, more rarely subclavate, mostly furcate to lobate, irregular or diverticulate. Trama hyphae cylindrical, non-dextrinoid, up to 12 μm wide. Pileipellis typically "jigsaw puzzle-like"(dryophila-type), with strongly diverticulate elements, smooth or incrusted. Stipitipellis a cutis, of cylindrical, parallel, slightly thick-walled, up to 5.0 μm wide hyphae. Hairs of the stipe covering up to 50 × 1.0-5.0 μm, filiform or vermiform, thin- to moderately thick-walled, arising from clusters of diverticulate terminal elements, similar to cheilocystidia. Clamp-connections present in all tissues.

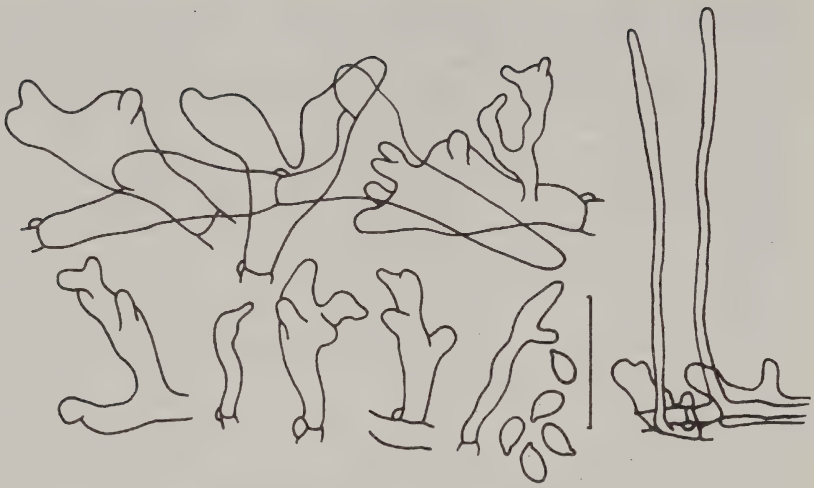
Chemical reactions: KOH on pileus none.

Ecology: Gregarious in Mediterranean thermophilous forests among vegetal debris, especially of *Quercus ilex*, *Pinus*, or more rarely *Cistus*.

Distribution and phenology: Known from northern Africa (Mauritania), and southern Europe (France, Italy and Spain).

Material studied: ITALY: Roma: Villa Ada, under *Robinia pseudoacacia*, *Laurus nobilis* and *Quercus ilex*, 8 Nov. 1983 leg. G. Lonati (herb. Lonati, duplicate AH). **SPAIN:** Granada: Sierra Elvira, under *Quercus ilex* subsp. *ballota*, 28 Oct. 1979 leg. R. Galán (GDA 10328); Bolones, Parque natural de la Sierra de Huétor, under *Pinus halepensis*, 2 Jan. 1996 leg. L. Alcoba and A. Ortega (GDA 42754, AH 25268); Málaga: Yunquera, parque natural de la Sierra de las Nieves, puerto de la Caína, under *Cistus albidus*, 30 Nov. 1995 leg. F. Esteve-Raventós, E. Horak, G. Moreno and A. Ortega (GDA 44974); Road Málaga-Colmenar, venta de Garvey, in *Pinus* forest, 10 Nov. 2000 leg. L. Alcoba and A. Ortega (neotype GDA 44739, isoneotypes AH 26980 and BRNM 670686); Sevilla: Aznalcázar, pinar de Aznalcázar, under *Pinus pinea,* 18 Nov. 2000 (GDA 44740) and 31 March 2001 (GDA 44741) leg. L. Alcoba and A. Ortega.

This poorly known taxon was described in detail by MALENÇON & BERTAULT (1975), putting special emphasis to the presence of a finely velutinous stipe, the covering formed by cylindrical, thin-walled hairs or caulocystidia. There is no doubt that the original description represents the well-known *G. dryophilus*, except for the pubescent stipe. The material studied by us differs from the typical *G. dryophilus* also in having smaller cheilocystidia and longer basidia.



Gymnopus dryophilus var. *lanipes* (neotype): pileipellis cells (upper left), cheilocystidia (lower left), spores and hairs of the stipe cover (right). Scale bar = 20 µm.

The material deposited as a holotype (nº 4508) in Malençon's herbarium at Montpellier (MPU) was studied by us, and it does not correspond to the taxon described in the protologue. Although it has a pubescent stipe, its spores are larger (9-11 × 4-5 µm), the pileipellis is a cutis of typical filamentous hyphae without a dryophila-structure, and the basidiomata are brown-reddish. These characters do not agree with *G. dryophilus*, but it may represent a taxon from the *G. terginus* group. Because Malençon knew *G. terginus* very well, a designation of such material was surely an unintentional error. Therefore, because of the absence of any paratypic collection, we selected a neotypus from Iberian material which fits the original description in all aspects, and keeps the originally used name.

Gymnopus dryophilus var. *lanipes* might be confused with pale or dehydrated forms of *G. pubipes*, both sharing a pubescent stipe. *Gymnopus dryophilus* var. *lanipes* can be distinguished macroscopically by the whitish to cream lamellae and the absence of rhizoids at the stipe base, and microscopically by its smaller spores and the inconspicuous cylindrical, often diverticulate cheilocystidia. Moreover, the chemical reaction with KOH on the pileus is a good character to distinguish both species.

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PHALLUS PYGMAEUS, A NEW MINUTE SPECIES FROM A BRAZILIAN TROPICAL RAIN FOREST

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ABSTRACT - *Phallus pygmaeus*, a remarkable new species fundamentally characterized by its basidiomata not exceeding 10 mm high, smooth surface of the dark pileus and lignicolous habitat, is described and illustrated.

KEYWORDS - Neotropics, Phallales, gasteromycetes, taxonomy

INTRODUCTION

Recent collecting activities in Northeastern Brazil have revealed a rich macromycete biota (Gibertoni & Cavalcanti 2000; Baseia & Galvão 2002; Baseia & Milanez 2002). Ongoing taxonomic studies in this poorly explored neotropical region allowed the discovering of a new and interesting phalloid.

According to Kreisel (1996), in a preliminary survey of the genus *Phallus* Pers. sensu lato, 31 species were accepted; from those 3 were limited to the New World, 18 to the Old World, and 10 were known from both hemispheres, although in a few cases the apparent wide distribution may be due to introduction by man.

The most important morphological criteria for the infrageneric taxonomy of *Phallus* are the shape and surface configuration of the pileus, coloration of the receptacle and volva, and the size of the basidiomata (Ventenat 1798, Lloyd 1909, Dring & Rose 1976, Kreisel 1996).

MATERIALS AND METHODS

Collecting expeditions to the Gurjaú Ecological Station, a remnant of the Atlantic rain forest, located in the State of Pernambuco (8°21´30´´- 8°12´00´´ S and 31°56´30´´- 35°45´30´´ W), were conducted during June 2002.

Basidiomata were examined in the field for their fresh characteristics. Colors were coded according to Kornerup & Wanscher (1978; ´KW´ code noted in parenthesis) and described subjectively. Basidiomata were dried slowly over a stove and placed in containers with naphthalene to prevent spoilage in the excessively humid conditions. In addition, some basidiomata were pickled fresh in FAA.

Microscopic anatomical details were determined from dried and pickled specimens with a Zeiss microscope with bright field and phase contrast optics.

Features were observed in 3% KOH and Melzer´s reagent. A total of 30 spores were measured from the holotype and subsequent collection. The material was preserved at the Herbarium Father Camille Torrend (URM).

TAXONOMIC SECTION

Phallus pygmaeus Baseia sp. nov.

Figs 1-2

Ovo subgloboso, 2-3 mm diametro, epigeae, colore superius olivacea brunnea, inferius aureo albo, mycelli filamentis robustis; stipite cylindrico, reticulato, colore albo, 5-10 mm alto, 1-2 mm lato; pileo campanulato, apice cum orificio, superficie gleba gelatinosa, laevi, olivacea brunnea; sporis ellipsoideis, laevis, 3-4 x 1-1,5 µm, hyalinis. Carnis putridae odore.

Ad lignum putridum. Holotypus: Brasil, Pernambuco, Gurjaú, 28/VI/2002, leg. I. G. Baseia and T. B. Gibertoni, in Herb. URM nº 77078 conservatus est.; isotypus: URM nº 77079.

Egg subglobose, 2-3 mm diam., epigeal, olive brown (KW 4F4) at its apex, yellowish white (KW 4A2) at the lower part, mycelial cord strong; stipe cylindrical, reticulate, not pigmented, 5-10 mm high, 1-2 mm wide; pileus campanulate, apex perforate, glebal surface gelatinose, smooth, olive (KW 1F5); spores ellipsoid, smooth, 3-4 x 1-1.5 µm, hyaline. Beef cattle smell.

The epithet 'pygmaeus' refers to the very small basidiomata of this species.

Material studied: the holotype and isotype.

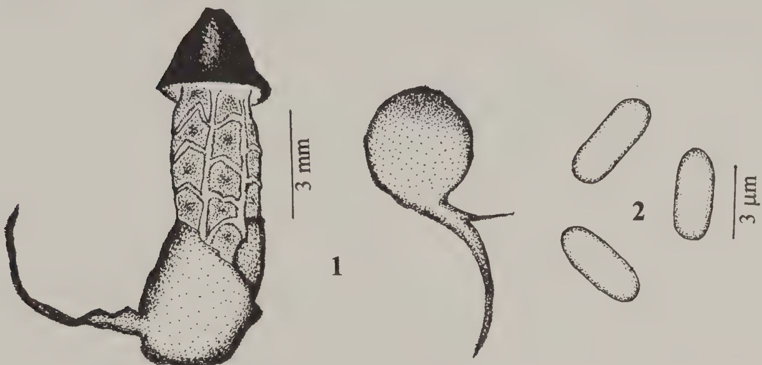
Habitat: groups on rotten woody.

Distribution: Brazil, State of Pernambuco.

Remarks: Gaudichaud (1827) described *Sophronia brasiliensis* Gaudich., which subsequently was considered a synonym of *Phallus indusiatus* Vent.: Pers. Later, Møller (1895) described four new Brazilian phalloid species: *Aporophallus subtilis* A. Møller (=*Phallus subtilis* (A. Møller) Lloyd), *Itajahya glutinolens* A. Møller (=*P. glutinolens* (A. Møller) O. Kuntze), *I. galericulata* A. Møller (=*P. galericulatus* (A. Møller) Kreisel) and *Dictyophora callichroa* today considered as *P. callichrous* (A. Møller) Lloyd. Since then, no new species of *Phallus* have been described from Brazil.

Phallus pygmaeus is usually easy to distinguish on account of its small basidiomata, nature of the dark pileus and lignicolous habitat. This new species recalls *P. impudicus* L.: Pers. in shape, color and spore size, differing, however, in the following characteristics: basidiomata not exceeding 10 mm high, and smooth surface of the pileus.

According to Kreisel (1996), the genus *Phallus* is divided in 5 subgenera: *Aporophallus* (A. Møller) Kreisel, *Itajahya* (A. Møller) Kreisel, *Endophallus* (M. Zang & R. H. Petersen) Kreisel, *Satyrus* (Bosc) Kreisel, and *Phallus*. Members of the subgenus *Phallus* have a campanulate pileus with perforate apex and yellow pigments, characteristics observed in *P. pygmaeus*. However, this taxon also possesses some common characteristics with subgenus *Aporophallus*, such as a campanulate pileus with a smooth surface; indusium absent and receptacle without pigments. It differs from subgenus *Aporophallus* by having an apical pore in the pileus. Following the subgeneric concepts of Kreisel (1996), *P. pygmaeus* forms an interesting link between subgenus *Phallus* and subgenus *Aporophallus*.



Figs 1-2 *Phallus pygmaeus*: 1. mature and immature basidiomata; 2. basidiospores

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PARACERATOCLADIUM POLYSETOSUM, A NEW RECORD FROM BRAZIL

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ABSTRACT

Paraceratocladium polysetosum has dark brown setae, monophialidic conidiogenous cells and hyaline, septate conidia. Brazilian material of this species differs in having polyphialidic conidiogenous cells. *P. polysetosum* from Brazil is illustrated, described, and compared with other *Paraceratocladium* species. Geographical distribution data is included.

Key words: Dematiaceous Hyphomycetes, mitosporic fungus, taxonomy

INTRODUCTION

During a survey of mitosporic fungi associated with leaf litter of native plants of "restinga" vegetation at the "Area de Proteção Ambiental (APA) das Lagoas e Dunas do Abaeté", Salvador, State of Bahia, the fungus *Paraceratocladium polysetosum* Castañeda was found.

The genus *Paraceratocladium* was erected by Castañeda (1987) and to date five species have been described: *P. silvestre* Castañeda (type species) and *P. polysetosum* Castañeda (Castañeda 1987), *P. triseptata* Dulymamode, W. Wu & Peerally (Dulymamode et al. 1998), *P. malaysianum* Goh & Hyde (Goh & Hyde 2000), and *P. seychellarum* Whitton, McKenzie & K.D. Hyde (Whitton et al. 2001). The criteria used to delimit the genus are presence of simple or branched setae, monophialidic or polyphialidic conidiogenous cells, and ovoid, ellipsoid or narrowly ellipsoid, cylindrical, acicular or falcate, 0-3-septate, hyaline conidia. Both *P. triseptata* and *P. seychellarum* have been described with polyphialidic conidiogenous cells. The

Brazilian fungus also has polyphialidic conidiogenous cells and thus differs from *P. polysetosum* as described by Castañeda (1987). A morphological comparison and distribution data for all species are presented in table 1.

Paraceratocladium polysetosum Castañeda, Fungi Cubenses II. INIFAT, Habana, Cuba: 9. 1987. (Fig. 1-6)

Setae solitary, erect, straight or flexuous, acerose, branched, septate, smooth, dark brown at the base and brown at apex, 185-300 x 5-8µm; branches 29-86 x 2-3µm; conidiophores irregulary branched, micronematous, arising on the surface of the setae and branches, smooth, pale brown; conidiogenous cells monophialidic or polyphialidic, usually intercalary, discrete, lageniform, smooth, pale brown 5-12 x 4.5-6.5µm; collarette 1.5-2.5 x 2-2.5µm; conidia solitary, aggregating in slimy masses, cylindric, base obtuse, apex slightly swollen, 1-septate, smooth, hyaline, 13.5-18 x 1.5-2.5µm.

Material examined: on dead leaves of *Manilkara salzmanii* (DC.) H.J. Lam. (Sapotaceae), BRAZIL, Bahia, APA das Lagoas e Dunas do Abaeté, F.F. Barbosa, 3. V. 2002, HUEFS 56647. (permanent slides).

The Brazilian material has smaller setae and slightly longer conidia than those described in the literature. Castañeda (1987) described setae of *P. polysetosum* as up to 450µm in length x 9-12µm wide at the base, and conidia as 14-17 x 2µm. However, this variation is probably influenced by the substrate or environmental conditions.

The Brazilian material was collected from fragments of leaf litter put in damp chambers. *P. polysetosum* was unique species present in all fragments suggesting that this fungus is the most important species colonizing and decomposing leaf litter of *Manilkara salzmanii*.

Table 1. Morphological comparison and geographical distribution of *Paraceratocladium* species.

Species	Setae	Conidiogenous cells	Conidia		Distribution
			shape	size (µm)	
P. malaysianum	simple	monophialidic	acerose	40-46 x 1.5-2	Malaysia
P. polysetosum	branched	monophialidic/ polyphialidic	cylindric	13.5-18 x 1.5-2.5	Cuba, Brazil
P. seychellarum	branched	monophialidic/ polyphialidic	ovoid	3-5.2 x 1.2-1.5	Seychelles
P. silvestre	simple	monophialidic	acicular	21-30 x 1-2	China, Cuba, Hong Kong, Malaysia, Mauritius
P. triseptatum	simple	polyphialidic	acerose	28-34 x 1.5-2.5	Mauritius

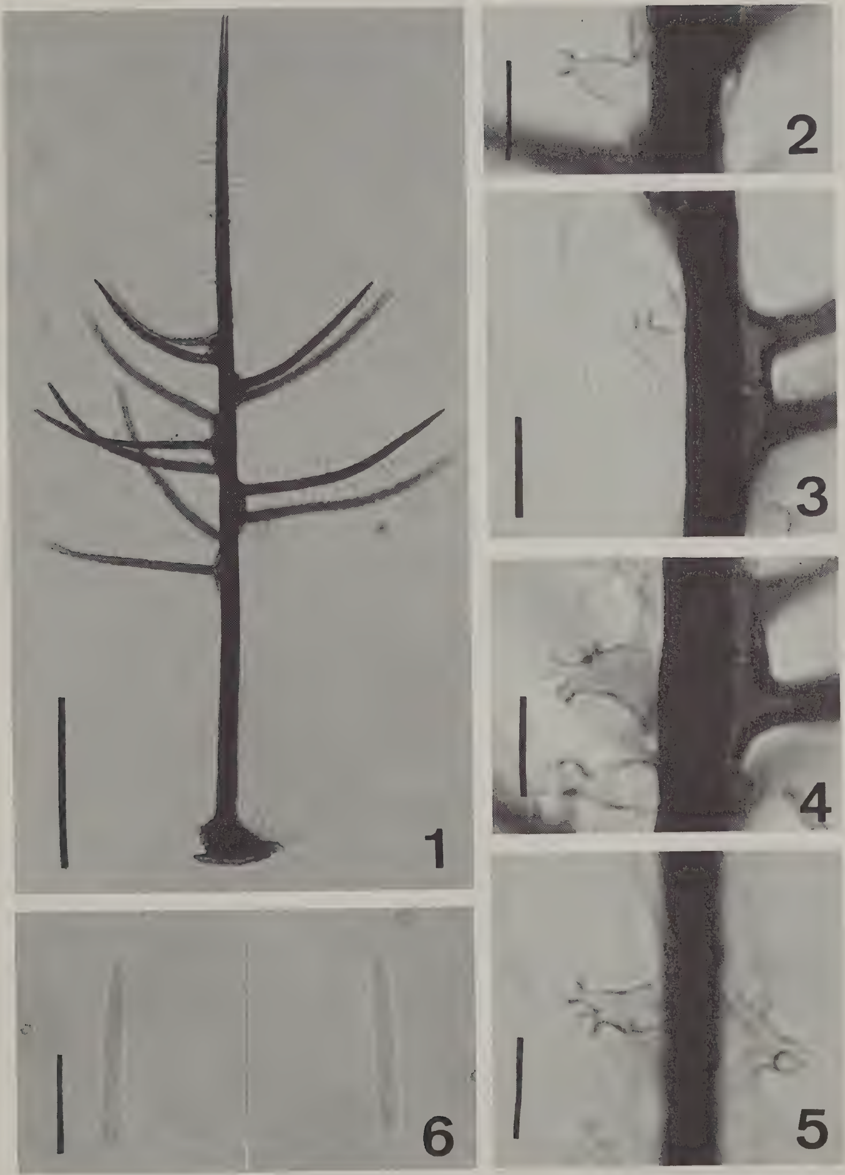

Fig. 1-6. ***Paraceratocladium polysetosum***. Fig. 1. Branched setae with entwined conidiophore. Fig. 2. Monophialidic conidiogenous cell. Figs 3-5. Polyphialidic conidiogenous cells. Fig. 6. Conidia. Bars: Fig. 1 = 50µm, Figs 2-5 = 10µm.

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BIOSYSTEMATICS OF THE MYXOMYCETES DIDYMIUM SQUAMULOSUM, PHYSARUM COMPRESSUM, AND PHYSARUM MELLEUM: ADDITIONAL ISOLATES

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Abstract: Twenty-four isolates of *Didymium squamulosum*, 18 isolates of *Physarum compressum*, and two isolates of *Physarum melleum* were cultured and their reproductive system determined. These isolates are additions to the 85 isolates (33 *D. squamulosum*, 33 *P. compressum*, and 19 *P. melleum*) that have been studied previously. Eleven of the 24 *D. squamulosum* isolates were nonheterothallic and presumptive apomictics, while the remaining 13 isolates belonged to three new biological species: A4 (three isolates from Costa Rica, sympatric with the A1 and A2 biological species), A5 (one isolate from Mexico), and A6 (one isolate from Thailand, two isolates from New Zealand, and six isolates from Australia). Seventeen of the *P. compressum* isolates were nonheterothallic, with the remaining isolate from Costa Rica (CR 18) being compatible with the previously determined A1 biological species isolated from the Canary Islands. Both of the *P. melleum* isolates were nonheterothallic. These results confirm and extend the conclusions derived from earlier studies. The *D. squamulosum* morphospecies, which consists of two overlapping morphotypes, appears to be an extremely complicated species complex consisting of numerous geographically restricted sympatric and allopatric biological species and many apomictic lines. The biological species are usually, but not always, confined to one of the morphotypes. On the other hand, the *P. compressum* morphospecies seems to be a species complex consisting of a single uncommon but widespread biological species and countless apomictic lines with relatively minor morphological variations. The *Physarum melleum* morphospecies is probably similar to *P. compressum*, although to date no heterothallic isolates have been reported.

Key Words: apomixis, biological species, heterothallism

INTRODUCTION

The taxonomy of the myxomycetes, at present, is based almost entirely on the morphology of the fruiting body and the use of the typological species concept (i.e., a particular species consists of individuals conforming to a constant morphological form that varies only within narrow boundaries). However, myxomycetes have a fairly restricted suite of morphological characters, and the discrete gaps between species necessary for the typological concept to be applied are often not present (Clark 2000). This, combined with the fact that many named species are variable and cosmopolitan and most of the rest are rare and of restricted distribution, has resulted in a rather muddled taxonomic situation that needs to be improved by introducing a more natural system based on experimental studies.

The myxomycete morphospecies *Didymium squamulosum* (Alb. & Schwein.) Fr., *Physarum compressum* Alb. & Schwein., and *Physarum melleum* (Berk. & Broome) Massee recently have been subjected to biosystematic studies (El Hage et al. 2000, Irawan et al. 2000, Clark and Stephenson 2000); however, the availability of additional isolates allows us to confirm and extend these previous studies. *Didymium squamulosum* has been reported to be a morphologically variable complex consisting of several biological species and numerous variable apomictic lines (El Hage et al. 2000), *P. compressum* has been reported to have little morphological variability and apparently consists of a single biological species with many closely related apomictic lines (Irawan et al. 2000), and *P. melleum* has been reported as consisting of numerous apomictic lines with relatively minor morphological variations (Clark and Stephenson 2000). Therefore, in an attempt to confirm these earlier observations and to produce a more solid foundation for an experimentally based taxonomy, additional isolates of these species were obtained and studied. These and other similar experimental studies may provide the necessary basis for a reevaluation of myxomycete taxonomy so that the present system can be replaced with a more natural system.

MATERIALS AND METHODS

The twenty-four isolates of *Didymium squamulosum*, 18 isolates of *Physarum compressum* and two isolates of *Physarum melleum* examined in this study were derived from moist chamber cultures, soil cultures or from field collections (TABLE I). Standard cultural and genetic procedures were used throughout the study (Clark 1995). In brief, plasmodia were grown on water agar (16 g plain agar per L of distilled water) and fed sterilized rolled oat flakes, and amoebae were grown on CM/2 agar (8 g corn meal agar and 8 g of plain agar per L of distilled water) with a film of sterile distilled water. Clonal amoebal populations were derived from isolated single spores or single amoebae. When the clonal amoebal populations produced plasmodia by themselves, they were classified as nonheterothallic, but when they required clonal mixing to produce plasmodia, they were considered heterothallic. Tester clones representing the two mating types from each heterothallic isolate were then crossed in all possible pair-wise combinations to determine multiple alleles (plasmodia produced in cross combinations with several different mating types) and biological species (plasmodia not produced in crosses between mating types of different isolates).

TABLE I Isolates and their origin

Isolates[a]	Location	Collection[b]	Substrate
Didymium squamulosum:			
Aust 1	Cape Tribulation, Queensland[c]	Stephenson 14962	aerial litter
Aust 2	Cape Tribulation, Queensland	Stephenson 14963	aerial litter
Aust 3	Cape Tribulation, Queensland	Stephenson 14964	aerial litter
Aust 4	Cape Tribulation, Queensland	Stephenson 14965	aerial litter
Aust 5	Cape Tribulation, Queensland	Stephenson 14966	aerial litter
Aust 6	Cape Tribulation, Queensland	Stephenson 14967	aerial litter
Aust 7	Cape Tribulation, Queensland	Stephenson 14968	aerial litter
Aust 8	Cape Tribulation, Queensland	Stephenson 14972	aerial litter
Aust 9	Cape Tribulation, Queensland	Stephenson 14982	aerial litter
Aust 10	Cape Tribulation, Queensland	Stephenson 14989A	aerial litter
CR 29	Monteverde Reserve[d]	Clark mc	*Heliconia* leaf litter
CR 30	Monteverde Reserve	Clark mc	*Heliconia* leaf litter
CR 31	Monteverde Reserve	Clark mc	*Heliconia* leaf litter
CR 32	Monteverde Reserve	Clark mc	*Heliconia* leaf litter
CR 33	Monteverde Reserve	Stephenson 12723	*Heliconia* leaf litter
CR 34	Culture contaminant[e]	Stephenson 14628	
Ha 1	Kipuka Puaulu Bird Park[f]	Landolt	soil culture
Mex 1	El Edén, Quintana Roö	Schnittler 16289	epiphyllic liter
NZ 1	Mill Bay, Auckland[g]	Stephenson 14480	palm frond
NZ 2	Mill Bay, Auckland	Stephenson 14487	palm frond
Ore 1	Oregon	Landolt	epiphytic soil culture
Tenn 1	Cosby CG, GSMNP[h]	Stephenson 11706	old straw bale
Thai 1	Kanchanaburi Falls	Stephenson 9149	forest floor litter

Trin 1	Trinidad	Clark mc	*Heliconia* leaf litter
Physarum compresum:			
Aust 1	Daintree National Park[i]	Stephenson 14516	aerial inflorescence
Aust 2	Daintree National Park	Stephenson 14625	aerial inflorescence
Aust 3	Cape Tribulation, Queensland	Stephenson 14973	aerial litter
Aust 4	Cape Tribulation, Queensland	Stephenson 14984	aerial litter
Aust 5	Cape Tribulation, Queensland	Stephenson 14989B	aerial litter
Aust 6	Daintree National Park	Stephenson 14990	aerial inflorescence
CR 3	Costa Rica	Clark mc	DelMonte banana peel
CR 4	Costa Rica	Clark mc	Chiquita banana peel
CR 18	Monteverde Reserve	Clark mc	*Heliconia* leaf liter
Col 1	Columbia	Clark mc	Turbana banana peel
Ecu 3c	Ecuador	Clark mc	Bonita banana peel
Ecu 6	Ecuador	Clark mc	Bonita banana peel
Gua 1	Guatemala	Clark mc	DelMonte banana peel
Guy 2	Guyana	Landolt	soil culture
Idn 3	Donayan/Kediri East Java	Clark mc	banana leaf litter
PR 4	Puerto Rico	Clark mc	forest floor litter
Tenn 1	Cosby CG, GSMNP	Stephenson 11704	litter
WV 1	Harrison Co., West Virginia	Stephenson 11731	old field litter
Physarum melleum:			
Mex 1	El Edén, Quinitana Roö	Stephenson 12626	palm aerial liter
SC 1	Bishopville, South Carolina	Stephenson 12289	dead leaf

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[a] Isolates = Letters indicate country or state of origin: Aust for Australia, CR for Costa Rica, Col for Columbia, Ecu for Ecuador, Gua for Guatemala, Guy for Guyana, Ha for Hawaii, Idn for Indonesia, Mex for Mexico, NZ for New Zealand, PR for Puerto Rico, SC for South Carolina, Tenn for Tennessee, Thai for Thailand, Trin for Trinidad, and WV for West Virginia.

[b] Collection = Clark mc for moist chamber culture by Clark, Landolt for soil culture by Landolt, and herbarium specimens supplied by Stephenson or Schnittler.

[c] Cape Tribulation, Northern Queensland, Australia, aerial litter collected with a canopy crane.

[d] Monteverde Cloud Forest Reserve in Costa Rica.

[e] Sporangia developed on litter collected in Australia, but the biological species is typical of Costa Rica and is most likely the results of cross contamination during moist chamber development.

[f] Kipuka Puaulu Bird Park in Hawaii Vocanoes National Park.

[g] Mill Bay west of Auckland, New Zealand.

[h] Cosby Campground, Great Smoky Mountains National Park.

[i] Ecolodge near Daintree National Park, Northern Queensland, Australia.

RESULTS

Reproductive systems *Didymium squamulosum* isolates Aust 3, Aust 6, Aust 7, Aust 9, CR 31, CR 32, CR 33, Ha 1, Ore 1, Tenn 1, and Trin 1 were found to be nonheterothallic. The 13 remaining *D. squamulosum* isolates were heterothallic and members of three different biological species. The CR 29, CR 30 and CR 34 isolates defined the A4 biological species and displayed six mating type alleles ($A4^1$ and $A4^2$ in CR 29, $A4^3$ and $A4^4$ in CR 30, $A4^5$ and $A4^6$ in CR 34). The lone Mex 1 isolate defined the A5 biological species and displayed two mating types ($A5^1$ and $A5^2$). The Thailand isolate, two New Zealand isolates, and six Australia isolates defined the A6 biological species, which displayed 12 mating types (Thai 1 = $A6^1$ and $A6^2$, NZ 1 = $A6^3$ and $A6^4$, NZ 2 = $A6^5$, Aust 1 = $A6^7$ and $A6^8$, Aust 2 = $A6^9$ and $A6^{10}$, Aust 4 = $A6^5$ and $A6^6$, Aust 5 = $A6^7$, Aust 8 = $A6^8$ and $A6^{11}$, Aust 10 = $A6^8$ and

A6^{12}) with the NZ 2 and Aust 5 isolates containing only a single mating type. Of the 18 *Physarum compressum* isolates, seventeen were nonheterothallic (Aust 1, Aust 2, Aust 3, Aust 4, Aust 5, Aust 6, CR 3, CR 4, Col 1, Ecu3c, Ecu 6, Gua 1, Guy 1, Idn 3, PR 4, Tenn 1, and WV 1), with CR 18 the lone heterothallic isolate. CR 18 displayed two mating types (A1^3 and A1^4) that were compatible with the previously identified A1 biological species defined by the CI 1 isolate from the Canary Islands, which carried the A1^1 and A1^2 mating type alleles. Both *Physarum melleum* isolates (Mex 1, SC 1) were nonheterothallic.

Morphology The morphology of the *Didymium squamulosum* isolates in this study conforms to the results of the earlier study (El Hage et al. 2000) in that they fall into two overlapping morphotypes: type 1 = fairly tall limy stalks and rugose peridial lime; type 2 = short limeless (in culture) stalks and fairly smooth thin peridial lime. Isolates Aust 1, Aust 6, CR 29, CR 30, and Ore 1 are type 1; isolates Aust 2, Aust 3, Aust 4, Aust 5, Aust 6, Aust 7, Aust 8. Aust 9, Aust 10, NZ 1, Thai 1, and Trin 1 are intermediate but with type 1 tendencies (low levels of lime on the stalk); isolates Mex 1, NZ 2, and CR 33 are intermediate but with type 2 tendencies; and isolates CR 31 CR 32, and CR 34 are type 2. The variations in the *Physarum compressum* isolates also matched those noted in earlier studies (Irawan et al. 2000), with some isolates displaying short stalks (CR 18 and Col 1), sporangial clustering (CR 3 and WV1), and a sporotheca shape varying from the description (long-stalked sporangia with a single napiform sporotheca) provided in Martin and Alexopolous (1969). Sporothecae were mostly reniform in this group of isolates, with a few allantoid (Col 1, Ecu 3c, and Idn 3) or napiform (CR 3, Gua 1, and PR 4) isolates. The Guy 2 isolate, which was tentatively placed in this species, had very poorly developed sporangia and its morphology could not be determined adequately. The *Physarum melleum* isolates were typical of the morphospecies, with the exception of the Mex 1 isolate, which had yellowish-orange instead of the normal orange colored peridial lime deposits.

DISCUSSION

The study of these additional isolates supports and extends the results of previous papers (El Hage et al. 2000, Irawan et al. 2000, Clark and Stephenson 2000). Additional sympatric and allopatric biological species were added to the already intricate complex known to exist for *Didymium squamulosum* (El Hage et al. 2000). The recovery of one and the same biological species from Australia, New Zealand, and Thailand is very different from the situation in Central America, where there seem to be a number of small sympatric biological species. This morphospecies apparently consists of two genetically and morphologically overlapping complexes, each of which consists of several biological species and numerous apomictic lines. One of these complexes generally conforms to the central core of the *D. squamulosum* description (Martin and Alexopoulos 1969), while the other resembles *Didymium dictyopodium* Nann.-Brem. & Yamam., as delimitated by Matsumoto (1999). Although these two complexes are not completely separated from each other, they are probably different enough to be considered distinct taxa from a practical point of view. However, the ten or so rare, recently described (see El Hage et al. 2000) species that differ from *D. squmulosum* in one or two characters (e.g., spore ornamentation and stalk color or lime) are likely to be local variants unworthy of species rank unless they can verified by cultural studies.

The discovery of a second heterothallic isolate in the generally low genetically and morphologically variable *Physarum compressum* complex supports the conclusion that this morphospecies is a coherent taxon consisting of a biological species core and numerous similar apomictic lines. However, the consistent occurrence of isolates with clustered sporangia indicates that the *Physarum nicaraguense* Macbr. morphospecies is not a supportable taxon. The Guy 2 isolate, which had been tentatively placed in the *P. compressum* complex, is probably related to *Physarum gyrosum* Rost., since it is very similar to the Guy 1 that was found to be a specimen of *P. gyrosum* on the basis of isozyme studies (Irawan et al. 2000).

The two new *Physarum melleum* isolates support the idea that this morphospecies is a complex of similar (peridial lime color is the major observed variation) apomictic lines. However, further studies may find a basal biological species, from which the lines are derived, a situation comparable to that found in *P. compressum*.

This paper, other studies on these three taxa (El Hage et al. 2000, Irawan et al. 2000, Clark and Stephenson 2000), and an examination of the literature (Clark 1995, Clark 2000) indicate that most morphospecies, examined to date, consist of a core of sexually reproducing heterothallic strains and a swarm of nonheterothallic clonal lines. Also, the sexual strains of a species may belong to a single biological species (Haskins et al. 2000), or they may be divided into a number of reproductively isolated sibling species that may be allopatrically (Clark and Stephenson 1990) or sympatrically (El Hage et al. 2000) distributed. Together, these variations produce a complex set of reproductive possibilities that, when combined with morphological variations, produce extremely messy species complexes. Therefore, the delimitation of true taxa in this group, on the basis of morphology alone, is rather problematic, and the description of a new species should not be undertaken without extensive studies. Special care should be taken to avoid the naming of rare species that differ from a widespread taxon in one or only a few characters, since these will very likely turn out to be variant local apomictic lines not deserving of a separate taxonomic description.

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NOTES ON PESTALOTIOPSIS FROM SOUTHERN CHINA

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ABSTRACT

More than 800 specimens of *Pestalotiopsis* and allied genera collected from southern China (Zhejiang, Guangxi, and Yunnan provinces) in 2000-2002 were examined. Among the fifty-five identified species of *Pestalotiopsis*, nine species formerly disposed in *Pestalotia sensu* Guba are transferred to *Pestalotiopsis.* They are *Pestalotiopsis alöes, P. clusia, P. elasticola*, *P. eusora*, *P. laughtonae*, *P. macrochaeta*, *P. mangifolia*, *P. scirpina,* and *P. vismiae*. In addition, ten species of *Pestalotiopsis* are new records in China.

Key words: new combinations; new records.

As part of our floral studies on *Pestalotiopsis* in China, more than 800 specimens of *Pestalotiopsis* and allied genera collected from southern China (Zhejiang, Guangxi, and Yunnan provinces) in 2000-2002 were examined and more than 150 isolates were obtained by single conidium culture method. The fifty-five *Pestalotiopsis* species and a few in allied genera including *Bartalinia robillardoides* Tassi, *Monochaetia camelliae* (Desm.) Allescher, *Seiridium anceps* (Saccardo) Sutton, *S. ceratosporum* (De Notaris) Nag Raj, *S. breviaristatum* (Tracy & Earle) Sutton, and *S. mali* (Ellis & Everhart) Nag Raj were identified according to the treatments of Steyaert (1949), Sutton (1980), and Nag Raj (1993). Among the identified species of *Pestalotiopsis,* nine species formerly disposed in *Pestalotia sensu* Guba (1961) are transferred to *Pestalotiopsis* and re-described. In addition, ten species of *Pestalotiopsis* are new records in China.

New Combinations of *Pestalotiopsis*

1. *Pestalotiopsis alöes* (Trinch.) J.X. Zhang et T. Xu, comb. nov. Fig. 1 芦荟拟盘多毛孢

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≡ *Pestalotia aloës* Trinch., Rend. Napoli Soc. Reale accad. Sc. Fisiche Maten. Napoli 48: 266, 1909.

Fruitbodies scattered, conidiomata acervuloid, subepidermal in origin and erumpent at maturity; conidia fusiform, 4-septate, usually without constriction at the septa, straight or slightly curved, 18.9~23.6×5.0~7.1 µm; three intermediate cells almost concolorous, dark brown, the lowest one slightly lighter, 11.8~15.3 µm long; apical and basal cell conic, hyaline, with 2~3 appendages at apex, long-filiform, diverging from the acute apex, 13.0~26.0 µm long; basal appendage single, 2.4~5.9 µm long.

Colony on PDA white, cottony, conidiomata aggregate, ink-like, reverse of the culture Ochraceous-Buff(Ridgway, 1912), with circular bands.

Specimens examined: On leaves of *Persea americana* Mill., (PSH2000 I -093), 13 XI 2000, Jinghong Yunnan（云南景洪); on leaves of *Roystonea regia* (HBK.) O.F. Cook, (PSH2000 I -094), 12 XI 2000, Jinghong, Yunnan.

According to Trinchieri's original description, conidia on dry scapes of *Aloe virens* How. are 19~25 × 5~7 µm and unusually narrow.

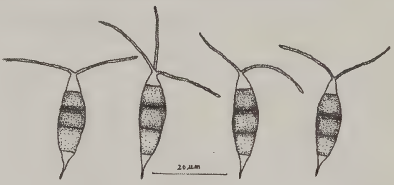

Fig. 1 Conidia of *Pestalotiopsis alöes* (Trinch.) J.X. Zhang et T. Xu

2. *Pestalotiopsis clusiae* (Griffon & Maubl.)J.X. Zhang et T. Xu, comb. nov. Fig. 2
克鲁希亚木拟盘多毛孢

≡ *Pestalotia clusiae* Griffon & Maubl., Bull. Soc. Mycol. Fr. 25: 239, 1909.

Spots large, of variable shape, gray white with gray brown margin. Fruitbodies punctiform, scattered, conidiomata acervuloid, subepidermal in origin and erumpent at maturity; conidia ovate-oblong often curved and unequilateral, 4-septate, usually without constriction at the septa, 18.9~24 × 7.7~10.0µm， intermediate three cells almost concolorous, dark brown, the lowest one slightly lighter, 13.0~16.5 µm, apical and basal cell conic, hyaline, with 2~3 appendages at apex, acrogenous or acropleurogenous, 18.9~28.3 µm long, basal appendage single, 2.4~7.5 µm long.

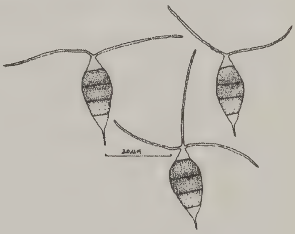

Fig. 2 Conidia of *Pestalotiopsis clusiae* （Griffon & Maubl.）J.X. Zhang et T. Xu

Colony on PDA white, cottony, fruitbodies ink-like, more or less gregarious, reverse of the culture Light Ochraceous-Salmon, without circular bands.

Specimen examined: On the leaves of *Areca triandra* Roxbg., (PSH2000 I -145), 12 XI 2000, Jinghong, Yunnan.

According to Griffon & Maublance's original description, conidia on leaves of *Clusia* sp. are corpulent, 20~25×8~10 µm and with long flexuous appendages.

3. *Pestalotiopsis elasticola* (P. Henn.) J.X. Zhang et T. Xu, comb. nov. Fig. 3

印度橡拟盘多毛孢

≡ *Pestalotia elasticola* P. Henn., Hedwigia 48: 16, 1908.

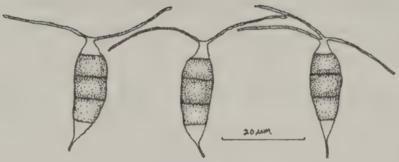

Fig. 3 Conidia of *Pestalotiopsis elasticola* （P. Henn.）J.X. Zhang et T. Xu

Spots pale, dried out with dark brown margin. Fruitbodies punctiform, scattered, conidiomata acervuloid, subepidermal in origin and erumpent at maturity; conidia long-fusiform, tapering towards the base, slightly constricted at the septa, 4-septate, straight or slightly curved, 23.6~28.3×5.9~8.3 μm, three intermediate cells almost concolorous or versicolour, the upper two umber, the lower one olivaceous, 14.2~18.9 μm long, apical cell conic, hyaline, basal cell acute, hyaline, with 2~3 appendages at apex, divergent, slender, 7.1~23.1 μm long, basal appendage single, 1.2~5.9 μm long.

Colony on PDA white, cottony, fruitbodies gregarious, ink-like, reverse of the culture colourless.

Specimen examined: On leaves of *Phoenix roeberenii* Brien, (PSH2000 I -109), 12 XI 2000, Jinghong, Yunnan.

According to Henning's original description, conidia on leaves of *Ficus elastica* are 14~20×7~10 μm with appendages 10~18 μm long.

This species differs from *Pestalotiopsis elasticae* (Koord.) P.L. Zhu, Q.X. Ge et T. Xu described on the same host plant in appendages without knob at the end and wider conidia.

4. *Pestalotiopsis eusora* (Sacc.) J.X. Zhang et T. Xu, comb. nov. Fig. 4 乌索拉拟盘多毛孢

≡ *Pestalotia funerea* Desm. var. *eusora* Sacc., Ann. Mycol. 6: 568, 1908.

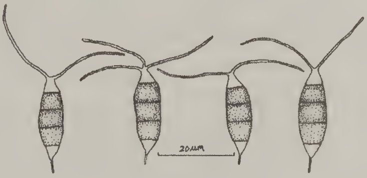

Fig. 4 Conidia of *Pestalotiopsis eusora* (Sacc.) J.X. Zhang et T. Xu

Fruitbodies scattered or gregarious, erumpent, black. Conidiomata acervuloid, conidia equilateral, narrow-fusiform, straight, 4-septate, usually without constrictions at the septa, 20.1~23.6×5.2~7.1 μm , three intermediate cells almost concolorous, the upper two brown to dark brown, the lower one olivaceous with melanin disposed at septa, 11.8~14.2 μm long, apical cell narrow-cylindric to acute, basal cell triangle, hyaline, with 2~3 appendages at apex, acrogenous or acropleurogenous, 11.8~21.2 μm long, basal appendage single, 3.5~7.1 μm long.

Specimens examined: On leaves of *Caryota mitis* Loureiro，(PSH2000 I -050), 18 VIII 2000, Qingxiu Mountain, Guangxi (广西青秀山); on leaves of *Roystonea regia* (HBK.) O.F. Cook, (PSH2000 I -010),7 VIII 2000, Nanning, Guangxi (广西南宁); on leaves of *Osmanthus pragrans* (PSH2000 I -070), 27 VIII 2000, Guilin, Guangxi (广西桂林).

According to Guba's description, conidia on withering leaves of *Heptapeurum barteri* Hiern. are 20~22×5. 5~6 μm (Guba, 1961).

5. *Pestalotiopsis laughtonae* (Doidge) J.X. Zhang et T. Xu, comb. nov. Fig. 5 劳格顿拟盘多毛孢

≡ *Pestalotia laughtonae* Doidge, Bothalia 4: 824, 1948.

Leaf spots irregular with dark brown margins. Fruitbodies punctiform, scattered or gregarious, conidiomata acervuloid, subepidermal then erumpent; conidia ovoid or broadly fusiform, 4-septate, usually not constricted at the septa, straight or unequilateral, 18.9~23.6×8.3~10.6 μm, three intermediate cells slightly swollen, versicolour, the upper two dark brown with deposition of melanin at septa, the lower one brown, 13.0~16.5 μm, apical cell cylindric or conic, basal cell turbinate, hyaline, with 2~3 appendages at apex, widely divergent, 15.3~28.3 μm long, basal appendage single, 2.4~5.9 μm long.

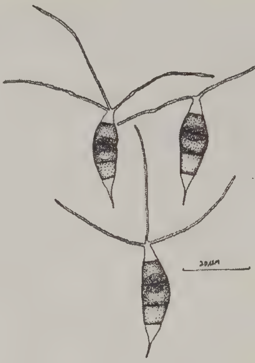

Fig. 5 Conidia of *Pestalotiopsis laughtonae* (Doidge) J.X. Zhang et T. Xu

Colony on PDA white, cottony, fruitbodies aggregate, ink-like, with circular bands, reverse of the culture Mars Yellow.

Specimen examined: On leaves of *Caryota ochlandra* Hance, (PSH2000 I -126), 9 XI 2000, Menglun, Yunnan (云南勐伦).

According to the original description, conidia on leaves of *Cassine sphaerophylla* O. Ktze are 22.5~25×9~ 11 μm.

Steyaert (1949) placed *Pestalotia laughtonae* in synonymy with *Pestalotiopsis glandicola* (Cast.) Stey. [= *Pestalotia glandicola* (Cast.) Guba]: conidia 21~28×8~11 μm, three intermediate cells 16~20 μm, with 2~4 appendages at apex, 10~37 μm long. The later differs from *Pestalotiopsis laughtonae* in larger size of conidia and more appendages.

6. *Pestalotiopsis macrochaeta* (Speg.) J.X. Zhang et T. Xu, comb. nov. Fig. 6 马可罗拟盘多毛孢

≡ *Pestalotia funerea* Desm. var. *macrochaeta* Speg., Anal. Mus. Nac. Buenos Aires, Ser. III, 13: 412, 1911.

≡ *Pestalotia macrochaeta* (Speg.) Guba, Mycologia 24: 369, 1932.

Fruitbodies punctiform, scattered, conidiomata acervuloid, subepidermal in origin and erumpent at maturity; conidia long-fusiform, tapering towards the base, 4-septate, usually without constriction at the septa, straight, 24.8~33.0×6.6~7.6 μm, three intermediate cells almost concolorous, upper two gray brown, light on the lowest one, 13.0~21.2 μm, apical cell conic to cylindric, and basal cell conic, hyaline, with 2~3 (most 3) appendages at apex, acrogenous or acropleurogenous, 15.3~34.2 μm long, basal appendage single, longer, 7.1~11.8 μm long.

Colony on PDA white, cottony, fructifications slowly, fruitbodies scattered, ink-like, reverse of the culture Cinnamon-Rufous without circular bands.

Specimen examined: On leaves of *Ravenala madagascariensis* Adans., (PSH2000 Ⅰ -107), 10 XI 2000, Menglun, Yunnan.

According to Spegazzini's original description, conidia on decaying needles of *Pinus sylvertris* L. are 28~30×8~9 μm with appendages, 30 μm long.

7. *Pestalotiopsis mangifolia* (Guba) J.X. Zhang et T. Xu, comb. nov. Fig. 7 芒果拟盘多毛孢

≡ *Pestalotia mangifolia* Guba, Monograph of *Monochaetia* & *Pestalotia* p. 149, 1961.

Fruitbodies punctiform, gregarious or scattered, conidiomata acervuloid, subepidermal then erumpent; conidia fusiform or long-cylindric, 4-septate, slightly constricted at the septa, straight or slightly curved, 23.6~29.5×5.9~9.0 μm, three intermediate cells concolorous, upper two gray brown or olivaceous, light on the lowest one, 14.2~20.1 μm long, apical cell cylindric, and basal cell conic, hyaline, with 2~3 (mostly 3) appendages at apex, acrogenous or acropleurogenous, 20.1~28.3 μm, basal appendage single, 4.2~8.3 μm.

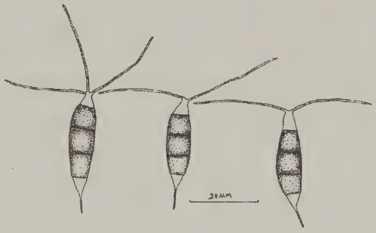

Fig. 6 Conidia of *Pestalotiopsis macrochaeta* (Speg.) J.X. Zhang et T. Xu

Colony on PDA white to yellowish, cottony, fruitbodies scattered, ink-like, reverse of the culture Capucine Buff, without circular bands.

Specimens examined: On leaves of *Bixa orellana* L., (PSH2000 Ⅰ -122), 9 XI 2000, Menglun, Yunnan; on leaves of *Mayodendron igneum* (Kurz.) Kurz, (PSH2000 Ⅰ -103), 10 XI 2000, Menglun, Yunnan; on leaves of *Crataegus pinnatifida* Bge., (PSH2000 Ⅰ -123), 9 XI 2000, Menglun, Yunnan.

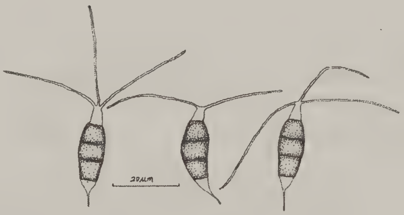

Fig. 7 Conidia of *Pestalotiopsis mangifolia* (Guba) J.X. Zhang et T. Xu

According to Guba's original description, conidia on dead brown areas in leaves of *Magnifera indica* L. are 22~28×6~8.5 μm and with 3 appendages 8~26 μm long.

This species differs from *Pestalotiopsis magniferae* P. Henn. broader conidia and longer appendages.

8. *Pestalotiopsis scirpina* (Ell. & G. Martin) J.X. Zhang et T. Xu, comb. nov. Fig. 8 藨草拟盘多毛孢

≡ *Pestalotia scirpina* Ell. & G. Martin, Am. Naturalist 19: 76, 1885.

= *Pestalotia versicolor* Speg. var. *americana* Speg., Anal. Soc. Ci. Argent. 13: 21, 1882.

= *Pestalotia linearis* Sacc., Nuovo Gior. Bot. Ital. (n .s.) 22: 67-68, 1915.

Fruitbodies punctiform, scattered, conidiomata acervuloid, subepidermal then erumpent; conidia clavate or broadly fusiform, 4-septate, constricted at the septa, usually curved and unequilateral, 20.1~26.0×9.0~11.8 μm, three intermediate cells versicolor, the upper two cells dark brown, the lower one brown, 15.3~18.9(~16.9) μm long, apical cell conic to columnar, and basal cell conic, hyaline, with 2~3 apical appendages, acrogenous or acropleurogenous, 22.4~34.2 μm long, basal appendage single, 2.8~5.9 μm long.

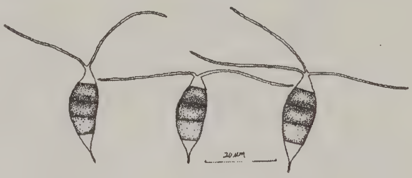

Fig .8 Conidia of *Pestalotiopsis scirpina*（Ell. & G. Martin）J.X. Zhang et T. Xu

Colony on PDA white, cottony, fruitbodies scattered, ink-like, reverse of the culture Apricot Buff, without circular bands.

Specimen examined: On leaves of *Myristica yunnanensis* Y.H. Li, (PSH2000 Ⅰ-108), 11 XI 2000, Menglun, Yunnan.

According to Ellis` description, conidia on decaying culms of *Scirpus maritimus* L. are 20~ 25×7~ 9 μm.

This species is different from *Pestalotiopsis versicolor* (Speg.) Stey. in the broader conidia.

9. *Pestalotiopsis vismiae* (Petr.) J.X. Zhang et T. Xu, comb. nov. Fig. 9 韦司梅拟盘多毛孢

≡ *Pestalotia vismiae* Petr., Sydowia 4: 561, 1950.

Spots irregular. Fruitbodies punctiform, loosely distributed, conidiomata acervuloid, subepidermal then erumpent; conidia long-fusiform, tapered towards ends, 4-septate, slightly constricted at the septa, straight or weakly curved, 20.1~23.6 × 5.2~6.6 μm, three intermediate cells almost concolorous, the upper two slightly brown, the lower one yellowish brown, 11.8~15.3 μm long, apical cell conic to columnar, and basal cell conic, hyaline, with 2~3 (mostly 2) apical appendages, acrogenous or acropleurogenous, 9.4~17.7 μm long, basal appendage single, 2.8~5.2 μm long.

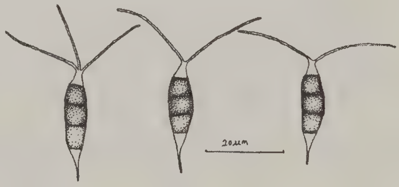

Fig. 9 Conidia of *Pestalotiopsis vismiae* (Petr.) J.X. Zhang et T. Xu

Colony on PDA white, cottony, fruitbodies scattered, ink-like, reverse of the culture Pale Orange-Yellow, without circular bands.

Specimens examined: On leaves of *Aucuba chinensis* Benth, (PSH2000 Ⅰ-063), 27 VIII 2000, Guilin, Guangxi; on leaves of *Cycas micholitzii* Dyer, (PSH2000 Ⅰ-039), 18 VIII 2000, Qingxiu Mountain, Guangxi; on leaves of *Phoenix canariensis* Chabaud, (PSH2000 Ⅰ-044), 18 VIII 2000, Qingxiu Mountain, Guangxi; on leaves of

Quercus variabilis Bl., (PSH2000 Ⅰ -138), 7 XI 2000, Kunming Botanical Garden, Yunnan (昆明植物园); on needles of *Cedrus deodara* (Roxb.) Loud., (PSH2000 Ⅰ -154), 6 XI 2000, Cuihu park Kunming, Yunnan (昆明翠湖公园); on leaves of *Amygdalus persica* L., (PSH2000 Ⅰ -081), 29 X 2000, Hangzhou, jiuxi, Zhejiang (浙江杭州九溪).

According to the original description, conidia on living leaves of *Visimia obtuse* Spruce are 18~22× 5~6.5 μm and with 2 appendages 10~23 μm long.

New records of *Pestalotiopsis* from China

1. *Pestalotiopsis calabae* (West.) Stey., Bull. Jard. Bot. État Bruxelles 19: 308, 1949. 胡桐拟盘多毛孢

≡ *Pestalotia calabae* West., Bull. Acad. Roy. Belg., Bruxelles, Ser. Ⅱ, 2: 556, 1857.

On leaves of *Dracontomelon duperreanum* Pierre, (PSH2000 Ⅰ -006), 7 VIII 2000, Guilin, Guangxi; on leaves of *Acacia confusa* Merr., (PSH2000 Ⅰ -009), 7 VIII 2000, Nanlin, Guangxi, on leaves of *Dimocarpus longan* Lour, (PSH2000 Ⅰ -029), 16 VIII 2000, Guangxi University campus.

2. *Pestalotiopsis ixorae* (Rangel) Batista & Peres *apud* Batista et al., Atas Inst. Micol. 3: 99, 1966. 龙船花拟盘多毛孢

≡ *Pestalotia ixorae* Rangel, Bol. Agr., Sao Poulo, 16: 321, 1915.

On leaves of *Ixora chinensis* Lam., (PSH2000 Ⅰ -140), 14 XI 2000, Jinghong, Yunnan.

3. *Pestalotiopsis leprogena*（Speg.）Steyaert, Darwiniana 12(2): 159, 1961. 甲普哥那拟盘多毛孢

≡ *Pestalotia leprogena* Speg., An. Mus. Nac. Hist. Nat. Buenos Aires 23: 109, 1912; Syll. Fung. 25: 604, 1931.

=*Pestalotia rhipsalidis* Grillo, Inst. Biol. Veg., Rio de Janeiro 1: 63-65, 1934.

On leaves of *Cycas revoluta*, (PSH2000 Ⅰ -038), 18 VIII 2000, Qingxiu Mountain, Guangxi.

4. *Pestalotiopsis maculiformans* (Guba & Zeller) Stey., Bull. Jard. Bot. État Bruxelles 19: 329, 1949. 点状拟盘多毛孢

≡ *Pestalotia maculiformans* Guba & Zeller, Mycologia 24: 370, 1932.

On leaves of *Taxus chinensis* (Pilg.) Rehd., (PSH2000 Ⅰ −137), 2000.11.7. Kunming Botanical Garden, Yunnan.

5. *Pestalotiopsis menezesiana* (Bres. & Torr.)Bissett, Can. J. Bot. 60: 2570, 1982. 弥泽那拟盘多毛孢

≡ *Pestalotia menezesiana* Bres. &Torr., Broteria ser. Bot, 8: 142, 1909.

On leaves of *Ravenala madagascariensis* Adans，(PSH2000 Ⅰ -111), 2000.11.12. Jinghong, Yunnan; on leaves of *Rhododendron stamineum* Franch., (PSH2000 Ⅰ 072), 27 VIII 2000, Guilin, Guangxi; on leaves of *Ravenala madagascariensis* Adans, (PSH2000 I -113), 9 XI 2000, Menglun, Yunnan.

6. *Pestalotiopsis oxyanthi* (Thuem.) Stey., Bull. Jard. Bot. État Bruxelles 19: 329, 1949. 尖花拟盘多毛孢

≡ *Pestalotia oxyanthi* Thuem. Inst. Rev. Sci. Litt. Coimbra 28: 420, 1880.

On leaves of *Zingiber officinale* Rosc., (PSH2000 I -139), 10 XI 2000, Menglun, Yunnan.

7. *Pestalotiopsis populi-nigrae* (Sawada & Ito) Morelet, Bull. Sci. Nat. Archeol. Toulon Var. 205: 9 1973. 钻天杨拟盘多毛孢

≡ *Pestalotia populi-nigrae* Sawada & Ito, Rep. For. Exp. Sta. Tokyo 45: 135, 1950.

=*Pestalotia lignorum* Gambogi. Publ. Inst. Pat. Veg. Microbiol. Agr. Univ. Pisa no. 332: 15, 1956.

On leaves of *Homalium luoticum*, (PSH2000 I -133), 9 XI 2000, Menglun, Yunnan.

8. *Pestalotiopsis sonsensis* (P. Henn.) Stey., Bull. Jard. Bot État Bruxelles 19: 336, 1949. 桑森拟盘多毛孢

≡ *Pestalotia sonsensis* P. Henn., Ann. Mus. du Congo, Bot., Ser. 5, 2(3): 229, 1908.

On leaves of *Mesua ferrea* L., (PSH2000 I -127), 9 XI 2000, Menglun, Yunnan.

9. *Pestalotiopsis triseta* Stey., Bull. Jard. Bot. État Bruxelles 19: 337-338, 1949. 三毛拟盘多毛孢

≡ *Pestalotia funerea* Desm. var. *macrochaeta* Speg. f. *triseta*, Rev. Mycol. 6: 49, 1941.

≡ *Pestalotia triseta* Guba, Monograph of *Monochaetia* and *Pestalotia* p. 244, 1961.

On leaves of *Caryota mitis* Cour., (PSH2000 I -088), 10 XI 2000, Menglun, Yunnan.

10. *Pestalotiopsis uvicola* (Speg.) Bissett., Can. J. Bot. 60: 2572, 1982. 尤韦可拟盘多毛孢

≡ *Pestalotia uvicola* Speg., in Thuem., Pilze Weinst, Vienna p. 13, 1878.

On leaves of *Mahonia acanthifolia* Wall. ex G. Don, (PSH2000 I -001), 7 VIII 2000, Nanning, Guangxi（广西南宁）; on leaves of *Cycas revoluta* Thunb., (PSH2000 I -035), 8 VIII 2000, Qingxiu Mountain, Guangxi; on leaves of *Macadamia integrifolia* Maiden, (PSH2000 I -002), 7 VIII 2000, Nanning, Guangxi.

ACKNOWLEDGEMENTS

The authors would like to thank Dr. W. Y. Zhuang for pre-submission review. Kind help of Prof. Y. X Chen and Prof. G. Wei of Guangxi University to collect specimens is also appreciated. This project was supported by National Natural Science Foundation of China.

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中国南方拟盘多毛孢属 *Pestalotiopsis* 志略

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摘要： 2000 至 2002 年期间，从浙江、广西、云南等地采集到 800 多份植物病害标本（寄主植物覆盖 49 个科），根据 Steyaert、Sutton 和 Nag Raj 的分类系统，鉴定了拟盘多毛孢属（*Pestalotiopsis*）55 个种，其中包括 9 个新组合，11 个国内新记录种。新组合为 *Pestalotiopsis alöes*、*P. clusiae*、*P. elasticola.*、*P. eusora.*、*P. laughtonae*、*P. macrochaeta*、*P. mangifolia*、*P. scirpina* 和 *P. vismiae.*。

关键词： 新组合 中国新记录

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POLYPORE FUNGI NEWLY RECORDED FROM TAIWAN

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ABSTRACT

Twelve species of polypore fungi are newly recorded from Taiwan, *viz.*, *Abundisporus roseoalbus*, *Antrodiella hydrophila*, *Ceriporiopsis lowei*, *Echinochaete brachyporus*, *Hexagonia hirta*, *Megasporoporia cavernulosa*, *Oxyporus corticola*, *Perenniporia isabellina*, *Polyporus dictyopus*, *Skeletocutis sensitiva*, *Theleporus calcicolor* and *Trametes pocas*. Cultural studies are provided for *E. brachyporus*, *H. hirta*, *Theleporus calcicolor*, and *Trametes pocas*.

Key words: Aphyllophorales, Basidiomycota, cultural studies, new records, Taxonomy.

Specimens of twelve polypore species newly recorded from Taiwan were collected from subtropical and tropical Taiwan during 1993-2001. All specimens are deposited in the herbarium of the National Museum of Natural Science of ROC (TNM). Some duplicates have been distributed to the herbarium of the University of Oslo (O). The cultural description and species code system are basically from Nobles (1965) with amendments by Boidin and Lanquetin (1983). Nobles' code as detailed by Nakasone (1990) was adopted in this study. General methods of cultural studies have been previously described (Wu, 1996).

1. ***Abundisporus roseoalbus*** (Jungh.) Ryvarden Belg. Journ. Bot. 131: 154. 1998.
Specimens examined. Taiwan. Taipei: Yangminshan National Park, Luchiaokenghsi Protected Area, on rotten wood of angiosperm, 350 m, coll. S.H. Wu et al., 21-X-2000, *Wu 0008-9* (TNM F12759). Taitung: Orchid Island, Hungtoushan, alt. 450 m, on rotten trunk of angiosperm, coll. S.Z. Chen, 24-IV-1997, *Chen 665* (TNM F8831, O).
Distribution. Paleotropical (Ryvarden and Johansen, 1980).

2. ***Antrodiella hydrophila*** (Berk. & Curt.) Ryvarden, Mycotaxon 20: 343. 1984.
Specimen examined. Taiwan. Taitung: Chihpen Forest Recreation Area, alt. 150 m, on wood, coll. S.H. Wu *et al*., 25-VI-1999, *Wu 9906-17* (TNM F10549).
Distribution. Central America, Africa (Ryvarden and Johansen, 1980), Taiwan.

3. ***Ceriporiopsis lowei*** Rajchenberg, Nordic J. Bot. 7: 564. 1987.
Specimens examined. Taiwan. Taitung: Orchid Island, between nuclear waste storage and Tasenshan, alt. 100 m, on branch of angiosperm, coll. S.H. Wu & J.Y. Tseng, 29-IV-1997, *Wu 9704-55* (TNM F8628, O), *Wu 9704-75* (TNM F8646, O).
Distribution. Australia, New Zealand (Rajchenberg, 1992), Brazil (type locality), Taiwan.

4. ***Echinochaete brachyporus*** (Mont.) Ryvarden, Bull. Jard. Bot. Nat. Belg. 48: 101. 1978.
Specimen examined. Taiwan. Taitung: Taimali, Chinjenshan, alt. 500 m, on rotten trunk of angiosperm, coll. S.C. Wu, 7-IV-2001, *Wu 0104-8* (TNM F12760).
Distribution. Pantropical (Núñez and Ryvarden, 1995).
Cultural description (PS-Mycelium of *Wu 0104-8*). Growth rate of 1-6 wk: Colony radius respectively 5-10, 16-23, 24-31, 31-42, 35-63, and 42-72 mm. 1 wk growth: Mat white, slightly brownish tinted. Advancing zone fairly even. Aerial mycelium slightly pellicular. 2 wk growth: Mat whitish, but inoculum and zonate area brown. Advancing zone uneven. Aerial mycelium absent or slightly pellicular, slightly irregularly zonate. 6 wk growth: Mat generally brownish tinted. Advancing zone uneven. Aerial mycelium absent or slightly pellicular, occasionally with slightly crustose patches, slightly irregularly zonate. Agar unchanged. No distinct odor. Not fruiting. Hyphal system monomitic. Advancing hyphae colorless, 2-4.5 µm diam., thin-walled, nodose-septate. Other hyphae colorless or brownish, 2-5 µm diam., thin-walled, simple- or nodose-septate, moderately branched, occasionally with brown oily contents. Setoid elements present (Fig. 1A). Thick-walled hyphal ends (Fig. 1B) present in crustose patches. Crystals present.
Oxidase reactions. GAA: –, 0; –, 0. TAA: –, 0; +, 5-8. TyA: +, 0; +, tr.

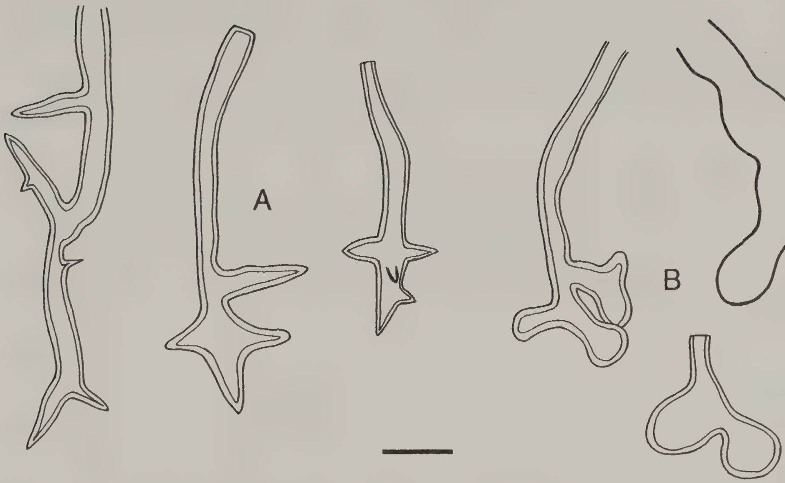

Fig. 1. Cultural features of *Echinochaete brachyporus* (*Wu 0104-8*). A. Setoid elements. B. Thick-walled hyphal ends from crustose patches. Culture after 6 wk of growth on 1.5% MEA at 25℃. Scale bar = 10 μm.

Nuclear behavior. Normal. Spores generally uninucleate, rarely binucleate, MS-mycelium monokaryotic, PS-mycelium dikaryotic.
Sexuality. Heterothallic tetrapolar (A_1B_1: 1; A_1B_2: 5, 8; A_2B_1: 3, 6, 7, 9; A_2B_2: 2, 4).
Species code. 2, 3i, 13, 32, 37, 38, 47, 54, 60, 61.

5. ***Hexagonia hirta*** (Fr.) Fr., Epicr. Syst. Mycol.: 497. 1838.
Specimen examined. Taiwan. Taitung: Taimali, alt. 100 m, on branch of angiosperm, coll. S.H. Wu *et al.*, 27-VI-1999, *Wu 9906-35* (TNM F10567).
Distribution. Africa (Ryvarden and Johansen, 1980), the Philippines (Ryvarden, 1989), Taiwan.
Cultural description (FB-mycelium of *Wu 9906-35*). Growth rate of 1-4 wk: Colony radius respectively 13-16, 32-40, 52-67, (90+) mm. 1 wk growth: Mat white. Advancing zone even. Aerial mycelium slightly pellicular. 2 wk growth: Mat white. Advancing zone even. Aerial mycelium slightly pellicular. 6 wk growth: Mat white to brown at pellicular region, brown at crustose region. Aerial mycelium generally pellicular, occasionally crustose. Agar turning brown. No distinct odor. Not fruiting. Hyphal system dimitic. Advancing hyphae colorless, 2-5 μm diam., thin-walled, nodose-septate. Aerial skeletal hyphae colorless or yellow, branched, 1-3 μm diam., slightly thick-walled, with distinct lumen. Aerial generative hyphae colorless to

brown, 1.5-3 μm diam., thin-walled, nodose-septate, moderately branched. Submerged hyphae colorless, 1.5-4 μm diam., thin-walled, nodose-septate, moderately branched. Crystals present.

Oxidase reactions. GAA: +++, 0; +++, 0. TAA: +++, 0; +++, 0. TYA: –, 21-28; –, 65-66.

Species code. 2a, 3c, 8, 32, 37, 39, 45, 54.

Remarks. Three species of *Hexagonia* bear long (> 7 mm long), branched, dark pileus hairs (Ryvarden and Johansen, 1980). *Hexagonia hirta* differs from *H. apiaria* in having smaller pores on the hymenial surface, and is distinct from *H. hydnoides* in having larger pores.

6. ***Megasporoporia cavernulosa*** (Berk.) Ryvarden, Mycotaxon 16: 174. 1982.

Specimens examined. Taiwan. Taitung: Orchid Island, between nuclear waste storage and Tasenshan, alt. 100 m, on branch of angiosperm, coll. S.H. Wu, 29-IV-1997, *Wu 9704-48* (TNM F8622). Green Island, Sleeping Beauty Rock, alt. 150 m, on branch of angiosperm, coll. S.Z. Chen, 9-IV-1998, *Chen 783* (TNM F8884), *Chen 784* (TNM F8885).

Distribution. Widespread in tropical America and Africa (Gilbertson and Ryvarden, 1987), Taiwan.

7. ***Oxyporus corticola*** (Fr.) Ryvarden, Persoonia 7: 19. 1972.

Specimen examined. Taiwan.Taichung: Kukuan, Malin, alt. 660 m, on bark of angiosperm, coll. C.Y. Chien, 8-VII-1996, *Wu 9607-1* (TNM F5336, O).

Distribution. Circumglobal (Gilbertson and Ryvarden, 1987).

8. ***Perenniporia isabellina*** (Pat. ex Sacc.) Ryvarden, Occas. Pap. Farlow Herb. Crypt. Bot. 18: 22. 1983.

Specimen examined. Taiwan. Kaohsiung: Liukuei, Shanping, alt. 750-780 m, on branch of angiosperm, coll. S.H. Wu, *Wu 9312-63* (TNM F1566, O).

Distribution. Venezuela (type locality), Taiwan.

9. ***Polyporus dictyopus*** Mont., Ann. Sci. Nat. Ser. II, 3: 349. 1835.

Specimen examined. Taiwan. Ilan: Fushan Botanical Garden, alt. 600m, on rotten wood, coll. W.N. Chou, 21-IV-1994, *CWN 00259* (TNM F1996).

Distribution. Pantropical (Núñez and Ryvarden, 1995).

10. ***Skeletocutis sensitiva*** (Lloyd) Ryvarden, Mycotaxon 44: 134. 1992.

Specimen examined. Taiwan. Nantou: Lienhuachih, alt. 700 m, on branch of

angiosperm, coll. S.H. Wu, 13-VII-1997, *Wu 9707-8* (TNM F9337, O).
Distribution. Japan (type locality), Taiwan.

11.***Theleporus calcicolor*** (Sacc. & Syd.) Ryvarden, Trans. Br. Mycol. Soc. 73: 12. 1979.
Specimens examined. Taiwan.Taitung: Orchid Island, on the way to Tienchih, alt. 100 m, on branch of angiosperm, coll. S.H. Wu & J.Y. Tseng, 1-V-1997, *Wu 9705-29* (TNM F8752); alt. 200 m, on branch of angiosperm, coll. S.Z. Chen, 22-IV-1997, *Chen 575* (TNM F8800, O); alt. 300 m, on branch of angiosperm, coll. S.Z. Chen, 15-VII-2000, *Chen 994* (TNM F12005).
Distribution. Paleotropical (Ryvarden and Johansen, 1980).
Cultural description (PS-mycelium of Wu 9705-29). 1 wk growth: Colony radius 45-47 mm. Mat white. Advancing zone even. Aerial mycelium slightly pellicular. 2 wk growth: Plates covered. Mat white. Aerial mycelium pellicular, zonate. 6 wk growth: Mat white. Aerial mycelium pellicular, slightly felty toward plate margin, slightly zonate. No distinct odor. Agar unchanged. Fruiting. Hyphal system trimitic. Advancing hyphae colorless, 2-5 µm diam., thin-walled, nodose-septate. Aerial generative hyphae colorless, 1.5-3 µm diam., generally thin-walled, occasionally slightly thick-walled, nodose-septate, moderately or sparsely branched. Aerial skeletal hyphae colorless, occasionally or rarely branched, 1-2.5 µm diam., thick-walled, almost solid. Aerial capilliform hyphae colorless, branched, 0.2-0.5 µm diam. Cystidioles fusiform, occasionally with one or more lateral branches. Basidioles occasionally with one or more lateral branch. Branched hyphidia present. Basidia clavate or subclavate, sometimes with a median constriction, sometimes with a lateral branch, 4-sterigmate, 26-42 x 5.3-6.5 µm. Basidiospores ellipsoid, smooth, thin-walled, 5.7-7 x 3.2-4 µm. The fertile features produced in the culture correspond with those in the basidiocarps fruiting in the nature. Submerged hyphae colorless, moderately branched, 2-5 µm diam., thin- to slightly thick-walled, nodose-septate; thick-walled cystidia fairly common, subglobose to elongate-cylindrical, sometimes irregularly constricted, quite often with a stalked base, 15-100 x 7-12 µm diam. Crystals present. See Fig. 2 for microscopic characters.
Oxidase reactions. GAA: +++, 0; +++, 0. TAA: +++, tr; +++, tr. TyA: –, 79-84; –, 90+.
Species code. 2a, 3c, 8, 13, 31g, 32, 36, 38, 42, 48, 54, 60, 61.
Sexuality. Tetrapolar (A_1B_1: 1, 10; A_1B_2: 5,7; A_2B_1: 3, 8; A_2B_2: 2, 4, 6, 9) (*Wu 9705-29*).
Nuclear behavior. Normal. Spores uninucleate, MS-mycelium monokaryotic, PS-mycelium dikaryotic (*Wu 9705-29*).

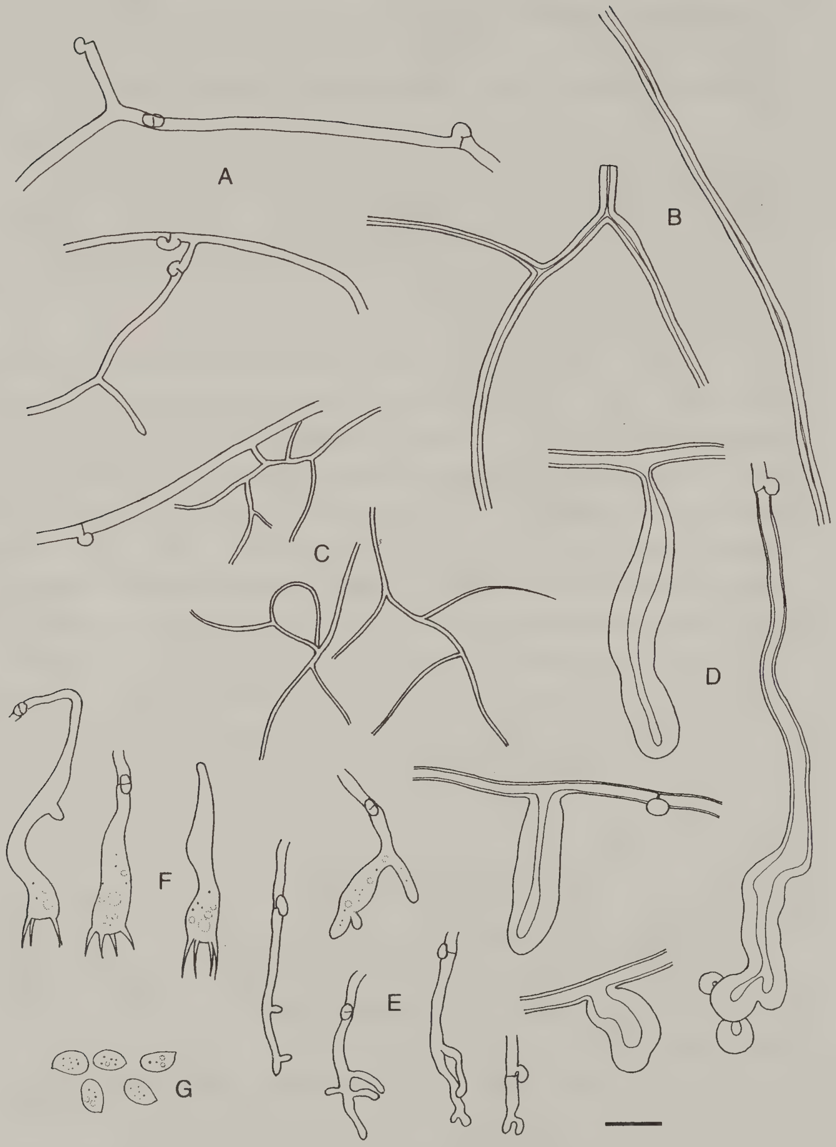

Fig. 2. Cultural features of *Theleporus calcicolor* (*Wu 9705-29*). A. Generative hyphae. B. Skeletal hyphae. C. Capilliform hyphae. D. Thick-walled cystidia. E. Branched hyphidia. F. Basidia. G. Basidiospores. Culture after 6 wk of growth on 1.5% MEA at 25℃. Scale bar = 10 μm.

12. ***Trametes pocas*** (Berk.) Ryvarden, Mycotaxon 20: 351. 1984.

Specimen examined. Taiwan. Nantou: Huisun Forest Farm, alt. 700 m, on rotten trunk of angiosperm, coll. S.H. Wu, 4-I-1999 *Wu 9901-18* (TNM F10249, O).

Distribution. Japan (Ryvarden, 1984), Africa (Ryvarden and Johansen, 1980, as *Trametes* cfr. *villosa*), Taiwan.

Cultural description (PS-mycelium of *Wu 9901-18*). 1 wk growth: Colony radius 25-33 mm. Mat white. Advancing zone uneven. Aerial mycelium absent, slightly pellicular towards growth margin. 2 wk growth: Colony radius 52-70 mm. Mat white. Advancing zone uneven. Aerial mycelium slightly pellicular, zonate. 3 wk growth: Plates partly covered. 6 wk growth: Plates covered. Mat white. Aerial mycelium slightly pellicular, slightly crustose, zonate. No distinct odor. Not fruiting. Agar unchanged. Hyphae system dimitic. Generative hyphae colorless, 1.5-4 µm diam., thin-walled, nodose-septate, moderately branched. Skeletal hyphae colorless, occasionally branched, 1-2 µm diam., thick-walled, almost solid. Cuboid crystals present.

Oxidase reactions. GAA: +++, 0; +++, 0. TAA: +, 0; +, 0. TYA: –, 56-61; –, 90+.

Species code. 2a, 3c, 8, 32, 36, 38, (43), 54, 60, 61.

Sexuality. Tetrapolar (A_1B_1: 1; A_1B_2: 4, 5, 9; A_2B_1: 2, 3, 6, 8; A_2B_2: 7).

Nuclear behavior. Normal. Spores uninucleate, MS-mycelium monokaryotic, PS-mycelium dikaryotic.

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NEW SPECIES OF MARASMIUS (BASIDIOMYCETES, TRICHOLOMATACEAE) FROM TROPICAL AFRICA - I. SECT. EPIPHYLLI, FUSICYSTIDES, GLOBULARES, HYGROMETRICI AND NEOSESSILES

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Abstract
Twelve new taxa (11 species and 1 variety) of the genus *Marasmius* s. str. (Basidiomycetes, Tricholomataceae) from tropical Africa are published. Six species (*M. albidocremeus, M. camerunensis, M. lacteoides, M. muramwyanensis, M. kigwenensis, M. tshopoensis*) belong to sect. *Globulares*, two species (and one variety) to sect. *Hygrometrici* (*M. minutoides, M. minutoides* var. *angustisporus, M. nyikae*), and one species each to sect. *Epiphylli* (*M. foliiphilus*), sect. *Fusicystides* (*M. longicystidiatus*) and sect. *Neosessiles* (*M. bururiensis*). Detailed macroscopic and microscopic description, drawings and a short discussion is given for each species. These studies represent a part of a larger taxonomic project dealing with African Marasmii.

Key words: Agaricales, new taxa, taxonomy.

Some years ago, I started intensive studies of African tropical species of the genus *Marasmius* s. str. My studies are based on both my own collections and herbarium specimens. The complete monograph will be published in a series "Flore illustrée des champignons d´Afrique centrale" edited by the National Botanical Garden in Meise (Brussels, Belgium).

This paper represents the first part of descriptions of new taxa with short discussions only. The complete comments, as well as colour photographs, will be published in a prepared monograph.

Microscopic features are described from examined material mounted in Melzer's reagent, Congo Red, and KOH. For the basidiospores the following factors are used: E (quotient of length and width in any one spore); Q (mean of E-values).

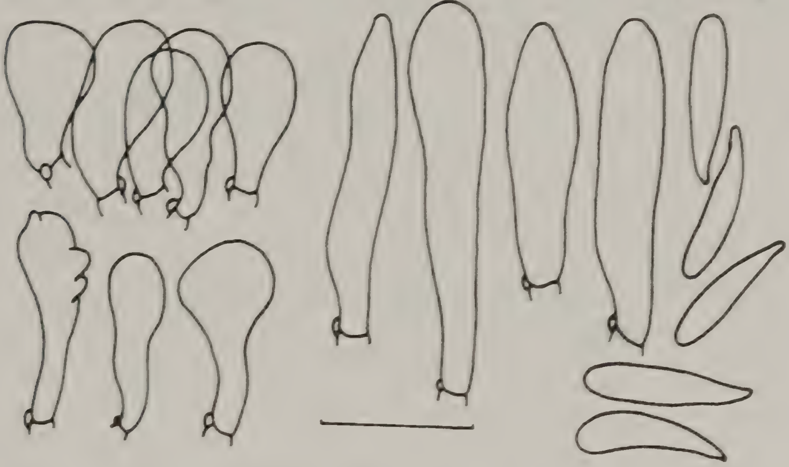
Marasmius albidocremeus **Antonín sp. nov.**

Pileo 12-30 mm lato, late conico cum centro truncato vel obtuso, dein conico-applanato, cum centro obtuso vel applanato, striato-sulcato, hygrophano, albido vel pallide cremeo cum margine albido-luteolo-griseolo. Lamellis distantibus, L = 11-13, l = 2-3, adnatis, latis, ventricosis, cremeis, acie concolore. Stipite 50-90 × 0.5-1.25 mm, cylindraceo, non-insititio, glabro, apicem albido vel cremeo, ad basim aurantiaco-brunneo vel aurantiaco-aureo. Sporis 16.5-23 × 3.5-5.0 µm, anguste clavatis vel sublacrymoideis, hyalinis, inamyloideis. Basidiis tetrasporis. Cheilocystidiis 10-31 × 6.0-11 µm, clavatis, tenuitunicatis. Pleurocystidiis (21-)27-48 × (4.5-)6.5-12 µm, clavatis, fusiformibus vel subcylindraceis. Pileipellis hymeniformis, e cellulis clavatis vel pyriformibus, 15-26 × 8.0-13(-15), laevibus. Pileocystidiis et caulocystidiis absentibus. Hyphis dextrinoideis, fibulatis. Ad lignum putridum.
HOLOTYPUS: Cameroon, area protecta biosphaerica Dja, Somalomo, 7. IV. 2001 leg. V. Antonín Cm01.27 (BRNM 666094)

Pileus 12-30 mm broad, broadly conical with truncate to obtuse centre, then plano-conical and obtuse to applanate at centre, straight to uplifted at crenulate margin, except for rugulose centre, entirely distinctly striate-plicate, hygrophanous, translucent, whitish to pale cream (4A2-5A3) at centre, almost white when dried-out, yellowish grey (slightly paler than 4B2) towards margin. Lamellae distant, L = 11-13, l = 2-3, slightly emarginate and ± adnate, ventricose, sometimes forming an adnexed false collarium, not intervenose, rather broad (up to 2.5 mm), cream, with concolorous edge. Stipe 50-90 x 0.5-1.25 mm, cylindrical, slightly broadened above, cylindrical to subclavate at base, glabrous, smooth, fistulose, whitish or creamy at apex, orange brown to (orange) golden (6C7, 6B-D8) at base, with pale ochraceous basal mycelium.
Spores 16.5-23 × 3.5-5.0 µm, E = 3.8-5.7, Q = 4.6, narrowly clavate, sublacrimoid, sometimes slightly curved, thin-walled, hyaline. Basidia 4-spored. Basidioles 12-29 × 3.0-8.0 µm, cylindrical, clavate, subfusoid. Cheilocystidia 10-31 × 6.0-11 µm, clavate, sometimes slightly irregular to lobate, smooth or with scattered projection(s), thin-walled. Pleurocystidia (21-)27-48 × (4.5-)6.5-12 µm, clavate, fusoid, subcylindrical, obtuse to subrostrate, hyaline. Hyphae cylindrical, thin-walled, hyaline, up to 10 µm wide. Pileipellis a hymeniderm, made up of 15-26 × 8.0-13(-15) µm, clavate to pyriform, thin- to slightly thick-walled, smooth, rarely irregular or with single projection(s), subhyaline to pale yellowish cells. Stipitipellis a cutis, of cylindrical, parallel, slightly thick-walled, up to 5.0 µm wide hyphae, with pale yellowish walls in KOH. Caulocystidia absent. Clamp-connections present in all tissues. Chemical reactions: Spores and hymenium non-dextrinoid; hyphae dextrinoid.
Ecology: Single or in groups, on strongly decayed wood, in a *Gilbertodendron dewevrei* stand.
Distribution: Known from two localities in Cameroon.
Studied specimens from tropical Africa: Cameroon, Dja Biosphere Reserve, near Somalomo, 7 April 2001 leg. V. Antonín Cm01.27 (holotype, BRNM 666094) and 8 April 2001 leg. V. Antonín Cm01.51 (BRNM 666117).

Marasmius albidocremeus is characterised by having a whitish or pale cream to dirty yellowish grey coloured pileus, a rather long and slender stipe, large narrowly clavate, sublacrymoid, sometimes slightly curved spores, and by the presence of clavate cheilocystidia, clavate or fusoid pleurocystidia, and the absence of caulocystidia. It belongs to sect. *Globulares* Kühner.

Concerning species with well-developed pleurocystidia, *Marasmius flavus* Singer (holotype BR!) seems to be a close species; it differs only microscopically in having smaller spores (13.5-15 x 3.1-3.5 µm), longer basidioles 30-39 x 4.0-11 µm, cheilocystidia (28.5-46 x 13-18.5 µm) and pleurocystidia [40-77 x 11.5-20(-23) µm].



Marasmius albidocremeus (holotype): pileipellis cells (upper left), cheilocystidia (lower left), pleurocystidia (middle) and spores (right). Scale bar = 20 µm.

Marasmius bururiensis Antonín sp. nov.

Pileo 5-10 mm lato, conchato, convexo, involuto, sulcato-striato, albido vel pallide luteolo-griseo, luteolo-griseo-brunneo vel griseo-luteolo, obscure brunneo vel nigro granuloso-spinoso. Lamellis distantibus, L = 6-10, l = 0(-1), adnatis, albidis, acie concolore et subtiliter granulosa. Stipite brevi vel absente, eccentrico vel laterali, cylindraceo, subtiliter fibrilloso, apicem luteolo-albido, ad basim brunneolo-griseo. Sporis 9.0-12.5(-13.1) × 5.0-7.0(-8.0) µm, ellipsoideis vel late ellipsoideis, hyalinis, inamyloideis. Basidiis tetrasporis. Cheilocystidiis 15.5-27.5 × 7.7-10 µm, clavatis vel late clavatis, in apice cum projectionibus irregularibus. Pleurocystidiis 30-48 × (6.0-) 7.5-13 µm, fusiformibus, rostratis, tenuitunicatis. Pileipellis hymeniformis, e cellulis clavatis vel vesiculosis, similibus cellulis hymenodermatis Marasmii rotalis, clavatis, subcylindraceis vel subfusiformibus, 9.2-23 × (5.4-)7.7-15.5 µm, crassitunicatis. Pileocystidiis infrequentibus vel absentibus, 22-26 × 5.5-6.0 µm, lageniformibus vel fusiformibus, tenuitunicatis. Caulocystidiis cylindraceis, clavatis vel subfusiformibus, usque 12 µm latis. Hyphis dextrinoideis, fibulatis. Ad ramos putridos.
Holotypus: Burundi, prov. Bururi, vallis Siguyaye, 3. II. 1979 leg. J. Rammeloo 6509 (holotypus in herbario BR 11926-92 asservatur).

Pileus 5-10 mm broad, shell-shaped, strongly convex, involute, thin, distinctly sulcate-striate, very pale off-white to light beige, beige brown-grey to greyish-yellow (± 4B3) with a tinge to yellowish white (4A2), striae slightly paler; covered by dark brown to almost black, somewhat spiny granules, largest and closest each to other at the point of attachment. Lamellae distant, L = 6-10, l = 0(-1), adnate, rather thick, 1-1.5 mm broad, not intervenose to slightly intervenose, sometimes branched (old carpophore), slightly convex, off-white, edge whitish, granulose. Stipe very short to absent, eccentric to lateral, c. 3 × ± 1 mm, ± cylindrical, strongly curved, very shortly adpressed fibrillose, yellowish white above, brownish greyish to brown at base. Context without special smell.

Spores 9.0-12.5(-13.1) × 5.0-7.0(-8.0) µm, E = 1.4-2.1, Q = 1.7-1.8, ellipsoid to broadly ellipsoid, hyaline, thin-walled. Basidia 24-34.5 × 9.0-13.0 µm, 4-spored, clavate. Basidioles 15.5-31.5 × 2.5-12.5 µm, clavate, cylindrical, subfusoid. Cheilocystidia in form of broom cells, 15.5-27.5 × 7.7-10 µm, clavate to broadly clavate, entirely thin-walled, rarely slightly thick-walled in upper part, (sub)hyaline; projections irregular, ± cylindrical, nodulose or coralloid, slightly thick-walled, up to 11.5 x 3.8 µm; similar but smooth cells rarely present among broom-cell cheilocystidia. Pleurocystidia distinct or indistinct, 30-48 × (6.0-)7.5-13 µm, fusoid, often rostrate, obtuse, rarely subacute, thin-walled, not incrusted, sometimes they seem to be slightly mucronate at apex. Hyphae cylindrical, smooth, ± hyaline, up to 10 µm wide, slightly brown pigmented or incrusted in subpileipellis; often slightly thick-walled, often inflated near septum, up to 10(-16) µm wide in stipe medulla. Pileipellis a hymeniderm, made up of broom cells of the Siccus-type, 9.2-23 × (5.4-)7.7-15.5 µm, clavate to vesiculose, less frequently subcylindrical, slightly to distinctly thick-walled (especially in upper part), basal part sometimes thin-walled, hyaline to brown in KOH; projections digitate, obtuse to subacute, often irregular or nodulose, up to 7.5 × 2.5 µm. Stipitipellis a cutis, of parallel, slightly thick-walled, smooth or incrusted, up to 7.0 µm wide hyphae. Caulocystidia (terminal cells) adpressed to often (sub)erect, often forming groups of clavate, cylindrical or subfusoid, thin-walled, obtuse, up to 12 µm wide cells. Clamp-connections present in all tissues. Chemical reactions: Spores non-dextrinoid and inamyloid, pileipellis cells, lamellae and pileus context hyphae non-dextrinoid, stipitipellis and stipe medulla hyphae slightly dextrinoid.

Ecology: Gregarious, growing on dead twigs in a montane rainforest and in a gallery forest.

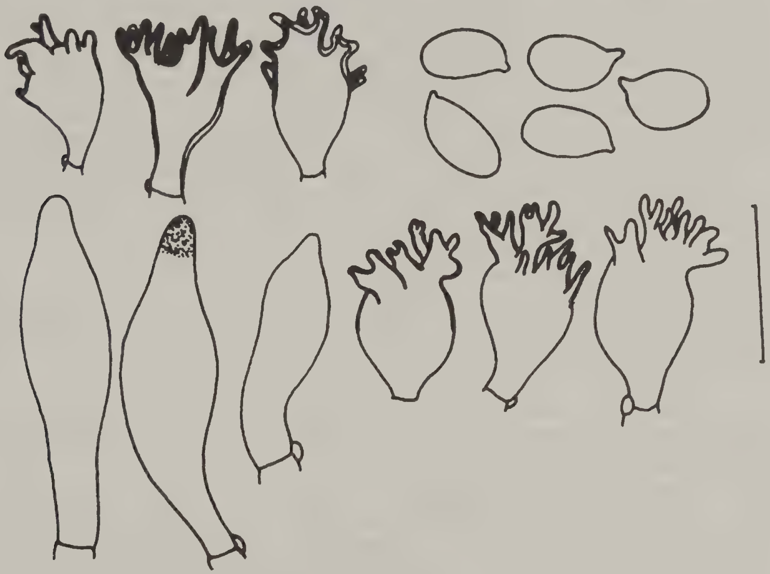
Distribution: Known from Burundi and Cameroon.

Studied specimens from tropical Africa: Burundi, T. Muramvya prov., Teza, 22 Dec. 1978 leg. J. Rammeloo 6241 (BR 11916-82). – Bururi prov., Siguyaye valley, W from Mutambara-Bururi road, 3 Feb. 1979 leg. J. Rammeloo 6509 (holotype, BR 11926-92). – Cameroon, Korup Forest Reserve, Mundemba, 27 Jan. 1989 leg. R. Watling (E).

Marasmius bururiensis is characterised by having a rather beige brown-grey to greyish-yellow, sulcate and spiny-granulose pileus, distant lamellae, very short to absent stipe, rather broad spores, and by the presence of cheilo- and pleurocystidia. It belongs to sect. *Neosessiles* Singer.

Only five species of this section have some hyphae dextrinoid. *Marasmius neosessilis* Singer has a different pileus colour, smaller spores (7-10 × 3.3-4.8 µm), and smaller pileipellis cells (Pegler 1977, Singer 1976); *M. griseoroseus* (Mont.) Dennis has a different pileus colour and larger and narrower spores [(9.5-)11.5-14.5 × 2.2-4.0 µm according to Singer 1976; 13-15.5 × 3.5-4.0 µm according to Dennis 1970]; *M. ustilago*

Singer has a deep fuscous pileus, a distinct stipe, narrower spores (x 5.3-5.5 μm), and two types of context hyphae (Singer 1976); *M. cecropiae* Dennis has a pale ochraceous, on drying fulvous orange to orange-buff coloured pileus, longer and narrower spores (11-14 × 4.0-4.8 μm) and fusoid cheilocystidia (Dennis 1961, Singer 1976); *M. paulensis* Singer has orange to pale orange pileus with concolorous lamellae, fusoid larger spores (12.5-15 × 4.5-6.2 μm), filamentous-cylindrical, rarely clavate pleurocystidia, rarely with some terminal projections and subhymeniform pileipellis (Singer 1976).



Marasmius buruiensis (holotype): pileipellis cells (upper left), spores (upper right), pleurocystidia (lower left) and cheilocystidia (lower right). Scale bar = 20 μm.

Marasmius camerunensis **Antonín & Mossebo sp. nov.**

Pileo 40-70 mm lato, convexo, sulcato-striato, centro brunneo-violaceo, margine albido vel ochraceo. Lamellis distantibus, L = 15, l = 0, adnexis, ventricosis, intervenosis, albidis, acie concolore. Stipite 40-70 × 4-6 mm, cylindraceo, glabro, apice albido, ad basim rubro-brunneo. Sporis (21-)23-28(-30) × 5.5-6.5(-7.0) μm, clavatis, lacrymoideis, clavato-cylindraceis, hyalinis, inamyloideis. Cheilocystidiis 10.0-25 × 8.5-11 μm, clavatis, late clavatis, tenuitunicatis. Pleurocystidiis absentibus. Pileipellis hymeniformis, e cellulis clavatis vel late clavatis, 17-27 × 8.0-18 μm, laevibus. Pileocystidiis et caulocystidiis absentibus. Hyphis dextrinoideis, fibulatis. Ad ramos putridos.
HOLOTYPUS: Cameroon, prov. Littoral, Poola´a, 20. VIII. 1998 leg. D. C. Mossebo M196(1) (holotypus in herbario BRNM 670732 asservatur, isotypus in herbario DM asservatur).

Pileus 40-70 mm broad, convex, deeply sulcate-striate, slightly rugulose except for a smooth area of 10-15 mm of diam. at centre, whitish to ochraceous with a slightly umbonate brown-violaceous centre. Lamellae distant, L = 15, l = 0, adnexed, 8-10 mm broad, ventricose, intervenose, white, with concolorous, entire edge. Stipe 40-70 × 4-6 mm, cylindrical, central, hollow, smooth, whitish and almost concolorous with lamellae at apex, reddish-brown towards base. Context concolorous with pileus, 2-5 mm broad in pileus centre.

Spores (21-)23-28(-30) × 5.5-6.5(-7.0) µm, E = 3.3-4.7, Q = 4.2, clavate, lacrymiform, clavate-cylindrical, thin-walled, hyaline, rarely uni- to triseptate. Basidia not found. Basidioles 13-35 × 8.5-10 µm, cylindrical, clavate, subfusoid. Cheilocystidia 10.0-25 × 8.5-11 µm, clavate, broadly clavate, rarely subcylindrical, thin-walled, hyaline. Pleurocystidia absent. Hyphae cylindrical, thin-walled, hyaline, 2.5-10.0 µm wide. Pileipellis a hymeniderm, made up of 17-27 × 8.0-18 µm, clavate to broadly clavate, thin- to slightly thick-walled, hyaline to pale greyish-yellowish, smooth cells. Caulocystidia absent. Clamp-connections present. Chemical reaction: Spores, hymenium and pileipellis cells non-dextrinoid; hyphae slightly dextrinoid (preserved in a conservation liquid).

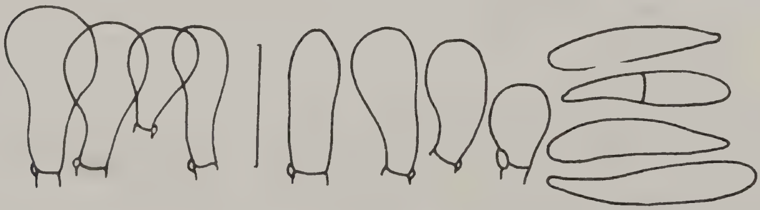
Ecology: Single, lignicolous, on dead branches in a coffee plantation.

Distribution: Known only from one locality in Cameroon.

Studied specimens from tropical Africa: Cameroon, Littoral prov., near Poola'a village, ca. 5 km from Nkongsamba, 20 Aug. 1998 leg. D. C. Mossebo M196(1) (DM, BRNM 670732).

Marasmius camerunensis is characterised by having rather large carpophores with a pale coloured non-striate pileus, broad lamellae, large spores, and by the absence of pleurocystidia. It belongs to sect. *Globulares* Kühner.

Among other African species with violaceous coloured or tinged pileus, *M. bekolacongoli* Beeli (holotype BR!), differs in having a violaceous and yellow striped pileus, longer stipe [80-150 × 2.5-6(-10) µm], smaller spores [17.5-24.5(-26) × (3.8-) 4.2-5.4 µm. Q = 5.1] and by growing on litter; *M. violaceus* Henn. (Singer 1964, 1965) has entirely violaceous coloured or tinged carpophores and smaller spores (15.5-22.3 × 3.3-5.0 µm); *M. zenkeri* Henn. (lectotype BR!) has larger carpophores, dark violaceous pileus, smaller spores [(15.5-)17.7-23.1 × 4.2-5.6 µm] and larger cheilocystidia (14-50 × 10-15 µm). *Marasmius caryotae* (Berk.) Petch has a straw to greyish yellow pileus, narrower stipe (40-80 × 1-2 mm) and fasciculate growth on fallen flowers of *Caryota* and on ground (Pegler 1986, Petch 1948).

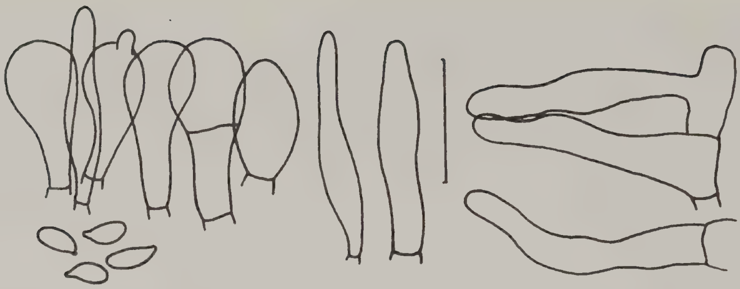


Marasmius camerunensis (holotype): pileipellis cells (upper left), cheilocystidia (upper right) and spores (lower). Scale bar = 20 µm.

***Marasmius foliiphilus* Antonín sp. nov.**

Pileo 2-8 mm lato, late convexo, centro applanato, obtuse umbonato vel depresso, glabro, centro ruguloso, margine striato vel ruguloso-striato, albo. Lamellis distantibus, L = 11-16, l = 0-2, emarginatis, late adnatis vel subtiliter decurrentibus, albidis, acie concolore et subtiliter fimbriata. Stipite 5-20 × usque 0.5 mm, cylindraceo, insititio, puberulo, junio albido, maturo ad basim brunneo. Sporis 6.0-8.0 × 2.5-3.5 µm, lacrymoideis, ellipsoideis-fusiformibus, hyalinis, inamyloideis. Basidiis tetrasporis. Cystidiis infrequentibus, 32-33 × 6.0-8.0 µm, lageniformibus vel fusiformibus, tenuitunicatis. Pileipellis hymeniformis, e cellulis clavatis, subcylindraceis vel subfusiformibus, 13-32 × (3.8-)5.0-12 µm, laevibus. Pileocystidiis infrequentibus vel absentibus, 22-26 × 5.5-6.0 µm, lageniformibus vel fusiformibus, tenuitunicatis. Caulocystidiis frequentibus, 13-70 × (4.0-)5.0-11 µm, cylindraceis, clavatis vel lageniformibus, frequenter irregularibus vel coralloideis. Hyphis dextrinoideis, efibulatis. Ad folia et in ramis putridis.
HOLOTYPUS: Cameroon, area protecta biosphaerica Dja, Ekom, 10. IV. 2001 leg. V. Antonín Cm01.77 (holotypus in herbario BRNM 666144 asservatur).

Pileus 2-8 mm broad, low convex, with applanate, slightly obtuse to slightly depressed centre, inflexed to almost straight at ± finely crenulate margin, glabrous, radially striate to rugulose-striate, except for rugulose centre, not hygrophanous, white. Lamellae well-developed, distant, L = 11-16, l = 0-2, slightly emarginate and broadly adnate to subdecurrent, not intervenose, sometimes furcate, white, with concolorous, finely pubescent edge. Stipe 5-20 × up to 0.5 mm, cylindrical, insititious, slightly broadened above, slightly broadened to subbulbose at base, entirely pubescent, hollow, entirely white when young, then white at apex and pale brown (± 6D5) towards base. Context thin, white in pileus, concolorous in stipe, without any distinct smell.
Spores 6.0-8.0 × 2.5-3.5 µm, E = 1.9-2.8, Q = 2.2-2.3, lacrymoid, ellipsoid-fusoid, thin-walled, hyaline. Basidia 18-28.5 × 6.0-8.0 µm, 4-spored, clavate. Basidioles 11-24 × 3.0-7.0 µm, clavate to cylindrical. Hymenial cystidia very rare to often absent, 32-33 × 6.0-8.0 µm, lageniform to fusoid, thin-walled. Hyphae cylindrical, thin-walled, up to 8.0 µm wide. Pileipellis a hymeniderm, made up of 13-32 × (3.8-)5.0-12 µm, clavate, subcylindrical to subfusoid, often in fascicles, smooth, rarely with some digitate projections or with a small rostrum, thin- to slightly thick-walled, sometimes septate. Pileocystidia very rare to often absent, 22-26 × 5.5-6.0 µm, lageniform or fusoid, thin-walled. Stipitipellis a cutis, of cylindrical, parallel, slightly thick-walled, up to 5.5 µm wide hyphae; medulla hyphae up to 12 µm wide. Caulocystidia numerous, 13-70 × (4.0) 5.0-11 µm, cylindrical, clavate, lageniform, often irregular, moniliform to subcoralloid, obtuse, adpressed to erect, thin- to mostly slightly thick-walled (more distinctly at base). Clamp-connections absent. Chemical reactions: Spores non-dextrinoid and inamyloid; pileus and lamellar trama hyphae slightly dextrinoid, stipe medulla and cortex hyphae distinctly dextrinoid.
Ecology: Single, growing in groups on dead fallen leaves and twigs, collected in a deteriorated forest of the Central African semideciduous type.
Distribution: Known only from Cameroon and the Democratic Republic of Congo.
Studied specimens from tropical Africa: Cameroon, Dja Biosphere Reserve, Ekom, ca. 34 km to E of Somalomo, 10 Apr. 2001 leg. V. Antonín Cm01.77 (BRNM 666144, holotype). – Democratic Republic of Congo, Tshopo prov., Ngene-Ngene, 18 Apr. 1984 leg. B. Buyck 1473 (BR 011750-13).



Marasmius foliiphilus (holotype): pileipellis cells, spores, hymenial cystidia and caulocystidia. Scale bar = 20 µm.

Marasmius foliiphilus belongs to sect. *Epiphylli* Singer. It is characterised by having entirely white carpophores (except for the stipe towards base when mature), with well-developed lamellae, small spores, often absent (sometimes very rare) pileocystidia and hymenial cystidia, clampless and dextrinoid hyphae. Having smooth pileipellis cells and dextrinoid hyphae, it belongs to subsect. *Eufoliatini* Singer.

Species belonging to this subsection are very rare in the tropics. Singer (1964, 1965, 1976) described two South-American species without clamps: *M. sanctixaverii* Singer and *M. caliensis* Singer. Both of them differ especially in having larger spores (8.2-9.7 × 3.8-4.5 µm, resp. 6.0-10.0 × 2.5-3.5 µm).

Marasmius kigwenensis **Antonín sp. nov.**

Pileo 26-30 mm lato, ± applanato, glabro, laevi, hygrophano, pallide cremeo cum centro obscuro. Lamellis confertis, L = ca. 40, l = 2-3, adnexis, angustis, pallide cremeis, acie concolore. Stipite 50-70 × 2-3 mm, cylindraceo, non-insititio, dense flocculoso, ad basim obscure brunneo. Sporis 5.8-6.6 × 3.1-3.7 µm, ellipsoideis vel lacrimoideis, hyalinis, inamyloides. Basidiis tetrasporis. Cheilocystidiis 15.5-23 × 3.5-5.4 µm, subcylindraceis, lageniformibus, nonnumquam rostratis vel subcapitatis. Pleurocystidiis absentibus. Pileipellis hymeniformis, e cellulis clavatis vel (sub)vesiculosis, 17.5-34.5 × 10.0-17.5 µm, laevibus. Pileocystidiis absentibus. Caulocystidiis 11.5-23 × 6.2-7.9 µm, (sub)cylindraceis, clavatis vel vesiculosis. Hyphis dextrinoideis, fibulatis. Ad lignum putridum.
HOLOTYPUS: Burundi, prov. Bururi, Kigwena, silva Kigwena, 22. II. 1979 J. Rammeloo 6709 (holotypus in herbario BR 11945-14 asservatur).

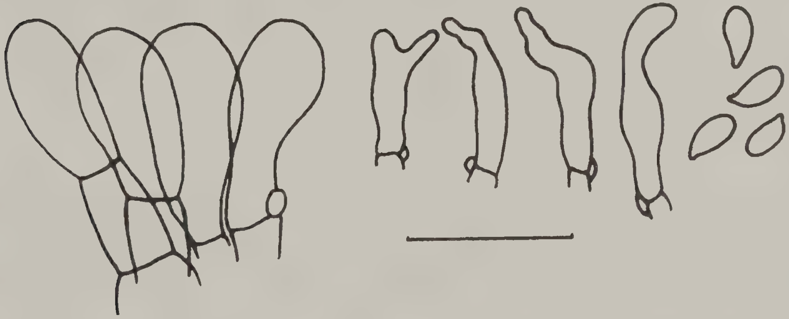
Pileus 26-30 mm broad, ± applanate, expanded, with slightly lobate to undulate margin, very thin (± 1 mm), glabrous, ± smooth, somewhat greasy on touch, slightly hygrophanous, pale cream with slightly darker centre, pallescent on drying. Lamellae very crowded, L = ca. 40, l = 2-3, adnexed, narrow (mostly < 1 mm), not intervenose, pale cream (like the pileus), with concolorous entire edge. Stipe 50-70 × 2-3 mm, cylindrical, sometimes slightly laterally compressed, usually somewhat twisted, hollow, densely finely floccose (lens), hard and tough, dark brown (± 7E7 to 7F7) towards base. Context tough, pale watery cream (like pileipellis), with fungoid taste and pleasant, somewhat perfumed smell.

Spores 5.8-6.6 × 3.1-3.7 µm, E = 1.6-2.0, Q = 1.8, ellipsoid to lacrimoid, thin-walled, hyaline. Basidia 18.5-20 × 5.8-7.3 µm, 4-spored, clavate. Basidioles 10.0-23 × 3.2-6.9 µm, clavate, cylindrical or subfusoid. Cheilocystidia 15.5-23 × 3.5-5.4 µm, subcylindrical, lageniform, sometimes rostrate or subcapitate, often irregular, rarely branched. Pleurocystidia absent. Hyphae cylindrical to inflated, thin- to slightly thick-walled, up to 20 µm wide. Pileipellis a hymeniderm, made up of 17.5-34.5 × 10.0-17.5 µm, clavate to (sub)vesiculose, smooth, ± thin-walled, hyaline cells. Stipitipellis a cutis, of parallel, cylindrical, slightly thick-walled, olivaceous greenish in KOH, up to 9.0 µm wide hyphae, smooth or sometimes with scattered lateral projections. Caulocystidia 11.5-23 × 6.2-7.9 µm, adpressed to erect, clavate, vesiculose or subcylindrical, slightly thick-walled, greenish in KOH. Clamp-connections present in all tissues. Chemical reaction: Spores, hymenium and pileipellis cells non-dextrinoid; hyphae and caulocystidia dextrinoid.

Ecology: In large groups, single or in small clusters, on rotten wood in humus layer.

Distribution: Known only from the type locality in Burundi.

Studied specimens from tropical Africa: Burundi, Bururi prov., Kigwena, Kigwena forest, 22 Feb. 1979 J. Rammeloo 6709 (BR 11945-14, holotype).



Marasmius kigwenensis (holotype): pileipellis cells, cheilocystidia and spores (from left to right). Scale bar = 20 µm.

Marasmius kigwenensis is characterised by a pale coloured pileus, very close lamellae, finely floccose stipe, small spores, irregular narrow cheilocystidia, the absence of pleurocystidia, the presence of caulocystidia, and stipitipellis hyphae turning greenish in KOH. It belongs to sect. *Globulares* Kühner.

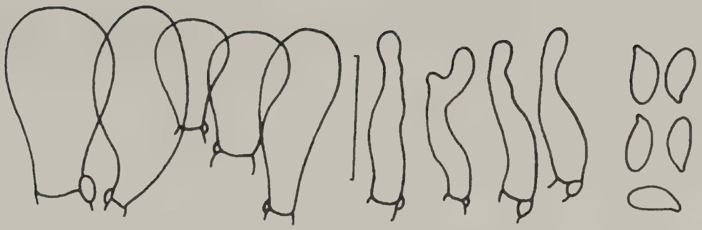
Among other African *Marasmius* species with small spores, *M. goossensiae* Beeli (lectotype BR!) differs in having a larger pileus (25-70 mm), subdistant lamellae, more robust stipe (x 3-8 mm), larger spores [6.2-7.9(-9.2) × 3.5-4.2 µm], and by the presence of pleurocystidia; *M. witteanus* Singer (holotype BR!) has an umbonate pileus, densely cespitose-fasciculate stipe, larger cheilocystidia [34.5-85(-135) × (7.0-)10-24(-34.5) µm] and developed pleurocystidia; *M. jodocodos* Henn. has violaceous coloured carpophores (Pegler 1977), *M. arborescens* (Henn.) Beeli (syntype BR!) densely cespitose stipes, larger spores and larger cheilocystidia, *M. albertianus* Singer (holotype BR!) larger spores, larger cheilocystidia, and lacks caulocystidia. In comparison with other species with small spores and no pleurocystidia, *M. rhysophyllus* Mont. differs by yellow coloured carpophores, intervenose lamellae and broader spores (5-6.5 × 3.5-4.5

µm); *M. cohortalis* Berk. has a pileus ochraceous at centre and whitish towards the margin, intervenose lamellae and larger spores (6.5-8.0 × 3-4.5 µm, however Dennis 1970: 5-7 × 2-3 µm) (Pegler 1983, Singer 1976), and *M. pellucidus* Berk. & Broome by a distinctly sulcate, milky white pileus, distant lamellae, smaller stipe (20-55 × 1.5-2 mm), and larger spores (8-10.5 × 3-4 µm according to Pegler 1986). Also the white coloured *Marasmius nivicola* Har. Takahashi differs especially by larger spores (6-8 × 3-4 µm) and different cheilocystidia and caulocystidia (Takahashi 2000a).

Marasmius lacteoides **Antonín sp. nov.**

Pileo 8-30 mm lato, junio late conico-haemisphaerico, mature convexo, centro obtuso vel papillato, hygrophano, glabro, mature ruguloso, albo-luteolo. Lamellis confertis, L = ca. 60, emarginatis, angustis, albidis vel cremeis. Stipite 35-60 × 2-3 mm, cylindraceo, non-insititio, puberulo, junio albido, maturo ad basim brunneo vel castaneo-brunneo. Sporis 6.2-8.5(-10.0) × 3.5-4.5 µm, ellipsoideis vel lacrimoideis, hyalinis, inamyloideis. Basidiis tetrasporis. Cheilocystidiis (11.5-)15-25 × 3.5-6.9 µm, clavatis vel subfusiformibus, subcylindraceis, tenuitunicatis. Pleurocystidiis absentibus. Pileipellis hymeniformis, e cellulis clavatis vel subpyriformibus, 17.5-27 × (7.0-)11.5-15(-17) µm, laevibus. Pileocystidiis absentibus. Caulocystidiis frequentibus, 19-35(-44) × (3.8-)5.4-7.7 µm, cylindraceis, clavatis vel lageniformibus, regularibus vel irregularibus. Hyphis dextrinoideis, fibulatis. Ad lignum et in ramis putridis.
HOLOTYPUS: Zambia, silva Chowo, 12. XII. 1981 leg. J. Rammeloo 7856 (holotypus in herbario BR K4441 asservatur).

Pileus 8-30 mm broad, broadly conical-hemispherical when young, then convex, obtuse or with small broad papilla at centre, with involute, then straight and undulate, only slightly translucently striate margin, hygrophanous, smooth, glabrous, later rugulose, whitish yellowish, whitish when dried out. Lamellae close, L = c. 60, with irregularly arranged lamellulae, emarginate with tooth, narrow, white to cream. Stipe 35-60 × 2-3 mm, cylindrical, slightly broadened above, slightly clavate at base, finely pubescent, entirely milky white when young, then brownish towards base, when old whitish at apex and through pale brown to chestnut brown towards base. Context white, concolorous with surface under pileipellis, hollow in stipe. [description according to slides]
Spores 6.2-8.5(-10.0) × 3.5-4.5 µm, E = 1.5-2.7, Q = 1.8-2.2, ellipsoid to sublacrimoid, hyaline. Basidia 18.5-26 × 6.5-8.5 µm, 4-spored, clavate. Basidioles 10.0-24 × 3.3-8.0 µm, clavate, fusoid, cylindrical. Cheilocystidia (10-)11.5-25 × 3.5-6.9 µm, clavate, subfusoid, subcylindrical, sometimes, often irregular, sometimes lobed or branched, thin-walled. Pleurocystidia absent. Hyphae of cylindrical, subfusoid or subinflated, ± thin-walled, hyaline, up to 15 µm wide cells, mixed (pileus) with thick-walled, 1.5-19 µm wide hyphae. Pileipellis a hymeniderm, made up of (13-)17.5-27 × (7.0-)11-15(-17) µm, clavate to pyriform, thin- to slightly thick-walled cells, smooth, hyaline in KOH. Stipitipellis a cutis, of parallel, cylindrical, thin- to slightly thick-walled, up to 5.0 µm wide hyphae, walls ± hyaline in KOH. Caulocystidia numerous, 19-35(-44) × (3.8-)5.4-7.7 µm, adpressed to erect, cylindrical, narrowly clavate, lageniform, sometimes irregular or branched, thin- to slightly thick-walled. Clamp-connections present in all tissues. Chemical reaction: Spores, hymenium and pileipellis cells non-dextrinoid; hyphae and caulocystidia dextrinoid.
Ecology: On rotting wood and dead twigs in litter.



Marasmius lacteoides (holotype): pileipellis cells, cheilocystidia and spores. Scale bar = 20 µm.

Distribution: Known only from Zambia.

Studied specimens from tropical Africa: Zambia, Chowo forest, 12 Dec. 1981 leg. J. Rammeloo 7856 (BR K 4441, holotype). – ibid., 10 Dec. 1981 leg. J. Rammeloo 7821 (BR K 4411).

Marasmius lacteoides belongs to sect. *Globulares* Kühner. It is characterised by having milky white carpophores, very close lamellae, small spores, the absence of pleurocystidia and the presence of caulocystidia.

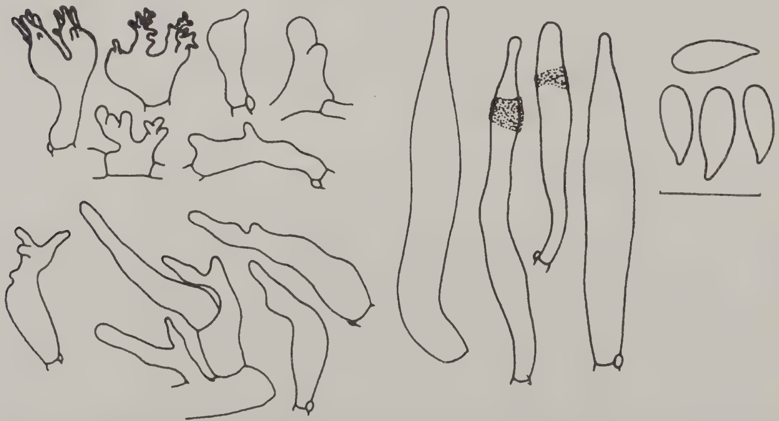
Macroscopically it is rather similar to *M. arborescens* (Henn.) Beeli (syntype BR!) which differs in having densely fasciculate stipes coloured red-brown towards base, slightly longer and narrower spores with different Q-ratio [(6.9-)8.1-11.5 × 3.0-4.0(-4.2) µm, Q = 2.4-2.8], larger cheilocystidia [16.5-31 × 6.6-12(-15.5) µm], larger pileipellis cells [19-35(-46) × (11-)13-19(-23) µm], and larger caulocystidia [(19-)24-54(-77) × 7.7-12.5 µm]. *Marasmius niveus* Mont. differs in having a larger (30-50 mm) strongly sulcate pileus, subclose to distant lamellae, glabrous stipe with fulvous to chestnut base, narrower spores (Singer 1976: 5.3-9.0 × 2.7-3.5 µm, Dennis 1970: 8.0-11 × 2.5-3.0 µm) and lacks caulocystidia (Singer 1976); *M. strictipes* (Peck) Singer has a larger (26-60 mm broad) pileus with a reticulose-rugose centre, a large stipe [47-81 × 1.5-5.5(-8) mm] with orange-cinnamomeous base, and narrow (26-28 × 2.0-5.0 µm) filamentous, cylindrical-flexuose to subclavate cheilocystidia; *M. pellucidus* Berk. & Broome has a reddish brown stipe towards base, distant lamellae (L = 12-20), smaller spores (6.0-7.5 × 2.5-3.5 µm) larger obtusely fusoid cheilocystidia (15-40 × 5-7 µm) and only thin-walled caulocystidia (Desjardin & Horak 1997); however, according to Pegler (1986) spores are 8-10.5 × 3.0-4.0 µm.

Marasmius longicystidiatus Antonín sp.nov.

Pileo usque 10 mm lato, convexo vel applanato-convexo, subtiliter tomentoso, ruguloso vel sulcato, roseo-ochraceo vel ochraceo. Lamellis distantibus, L = 6-13, l = 0-1, liberis vel adnatis, juventute pliciformibus, pallide aurantiaco-ochraceis. Stipite usque 3 × 1 mm, ± cylindraceo, eccentrico vel sublaterale, non-insititio, tomentoso vel hirsuto, albido vel pallide ochraceo. Sporis (14-)14.5-16.0(-17.5) × 5.4-6.6(-7.0) µm, clavatis vel lacrimoideis, hyalinis, inamyloideis. Basidiis 37-50 × 8.1-11.5 µm, tetrasporis. Cystidiis 45-115 × 7.0-14 µm, fusiformibus, subacutis, tenuitunicatis. Pileipellis cutiformis vel subhymeniformis, e hyphis laevibus vel diverticulatis, e cellulis clavatis, subcylindraceis vel subfusiformibus, regularibus vel irregularibus et e cellulis similibus cellulis hymenodermatis Marasmii sicci constructa. Pileocystidiis absentibus.

Caulocystidiis 23-39 × (3.8-)6.2-9.2 µm, cylindraceis, subfusiformibus vel sublageniformibus, irregularibus vel sub-coralloidis. Hyphis dextrinoideis, fibulatis. Ad ramos putridos.
HOLOTYPUS: Malawi, area protecta Nyika, Gîte Chelinda, 6. XII. 1981 leg. J. Rammeloo 7703 (holotypus in herbario BR 11995-64 asservatur).

Pileus up to ± 10 mm broad, convex to plano-convex, finely tomentose, radially rugulose to sulcate, pinkish ochraceous to ochraceous. Lamellae distant, L = 6-13, l = 0-1, ± free to adnate, ± pliciform when young, then well-developed, not branched, not intervenose, pale orange-ochraceous. Stipe well-developed, eccentric to sublateral, up to 3 × 1 mm, ± cylindrical to laterally compressed, curved, non-insititious, tomentose to hairy, whitish to pale ochraceous, with whitish basal path. [Notes according to slides.]
Spores (14-)14.5-16.0(-17.5) × 5.4-6.6(-7.0) µm, E = 2.2-2.9, Q = 2.5, clavate or lacrimoid, thin-walled, hyaline. Basidia 37-50 × 8.1-11.5 µm, 4-spored, clavate. Basidioles 15-44 × 3.5-10 µm, clavate, subcylindrical, subfusoid. Hymenial cystidia 45-115 × 7.0-14 µm, fusoid, subcylindrical, narrowly clavate, subacute, thin-walled. Hyphae ± cylindrical, ± thin-walled, up to 10 µm wide. Pileipellis a cutis, in some part transient to a (sub)hymeniderm, made up of three types of structures: 1. radially arranged, interwoven, ± cylindrical to subinflated, branched, smooth or incrusted, pale orange ochraceous in KOH, up to 8.0 µm wide hyphae; hyphae sometimes (scattered) diverticulate or with lateral projections (slightly developed Ramealis-structure), 2. clavate, subcylindrical to subfusoid, regular to irregular, lobate, ± thin-walled, smooth, ± hyaline cells; 3. broom cells of the Siccus-type, 16-25 × 6.0-13 µm, clavate or subcylindrical, regular or irregular, entirely or at least in upper part slightly thick-walled, pale orange ochraceous in KOH, with irregular, nodulose to subcoralloid, obtuse, slightly thick-walled projections. Pileocystidia absent. Stipitipellis a cutis, of parallel, cylindrical, slightly thick-walled, up to 6.0 µm wide hyphae. Caulocystidia 23-39 × (3.8-)6.2-9.2 µm, ± cylindrical, conical, subfusoid, sub-lageniform, irregular, often branched to subcoralloid, slightly thick-walled. Clamp-connections present. Chemical reaction: Spores non-dextrinoid and inamyloid; hyphae dextrinoid.



Marasmius longicystidiatus (holotype): pileipellis cells (upper left), caulocystidia (lower left), hymenial cystidia and spores. Scale bar = 20 µm.

Ecology: Growing on dead twigs in a montane forest (2300 m alt.).
Distribution: Known only from the type locality in Malawi.
Studied specimen from tropical Africa: Malawi, Nyika National Park, Gîte Chelinda, 6 Dec. 1981 leg. J. Rammeloo 7703 (BR 11995-64).

Marasmius longicystidiatus belongs to sect. *Fusicystides* Singer and is characterised by having a sulcate pinkish ochraceous to ochraceous pileus, distant pale orange-ochraceous lamellae, large spores, very long basidia and hymenial cystidia, and a pileipellis made up of three types of elements without pileocystidia.

Only two species of this section are known till now (Singer 1986). The neotropical *M. isabellinus* Pat. (= *M. fusicystis* Singer) has narrower spores (4.0-5.8 µm), smaller basidia (28-36 × 7.5-9.0 µm), smaller cystidia (20-80 × 4.0-10.0 µm), and developed pileocystidia (Singer 1976); the paleotropical *M. campanella* Holterm. has, according to Singer (1976) who revised the type material, narrower spores (14-16 x 4.3-4.5 µm).

Marasmius minutoides Antonín sp. nov.

Pileo 1-3 mm lato, convexo, centro applanato vel depresso, margine crenulato, subtiliter tomentoso vel granuloso, aeneo-brunneo vel obscure brunneo, maturitate luteolo-griseo, griseo-aurantiaco vel aurantiaco-griseo. Lamellis distantibus, L = 6-9, l = 0-1, adnatis, luteolo-albidis, acie concolore et subtiliter fimbriata. Stipite 3-12 × ca 0.3 mm, cylindraceo, insititio, glabro, apice pruinoso et luteo-albido, basin versus nigro-brunneo. Sporis (8.5-)9.5-12.5 × 4.5-6.0(-6.2) µm, ellipsoideis vel (sub)fusiformibus, hyalinis, inamyloideis. Basidiis tetrasporis. Cheilocystidiis e cellulis similibus cellulis cheilocystidiorum Marasmii rotalis, (8.0-)14-23 × (4.5-)7.0-13 µm, clavatis vel (sub)-vesiculosis et e cellulis lageniformibus vel fusiformibus, 23-33 × 5.0-9.0 µm. Pleurocystidiis similibus cheilocystidiis typi 2. Pileipellis hymeniformis, e cellulis clavatis, ellipsoideis vel vesiculosis, similibus cellulis hymenodermatis Marasmii rotalis, 13-25 × 7.0-15(-20) µm constructa. Pileocystidiis 17-25 × 5.0-9.0 µm, lageniformibus vel fusiformibus, laevibus vel basin versus cum diverticulis infrequentis. Caulocystidiis absentibus. Hyphis indextrinoideis, fibulatis. Ad folia et ramos putridos.
HOLOTYPUS: Rwanda, Butare-Cyangugu, km. 94, silva Rugege, 31. VIII. 1974 leg. J. Rammeloo JR 4433 (holotypus in herbario GENT asservatur).

Pileus 1-3 mm broad, convex, applanate to slightly depressed at centre, without central papilla, inflexed, then straight to slightly reflexed when old at crenulate and tomentose-pubescent margin, sulcate, translucently striate, slightly tomentose to granulose; entirely bronze to dark brown (5E6, 7E-F8) except for paler sulci when young, soon pallescent up to beige, greyish orange to orange grey (5B-C4, 6B2) towards the margin, sulci remaining paler, almost dirty whitish. Lamellae distant, L = 6-9, l = 0-1, short adnate, without a collarium, slightly intervenose at base when old, sometimes furcate; yellowish white (c. 3A2), edge entire, concolorous, slightly pubescent. Stipe 3-12 × c. 0.3 mm, thin-cylindrical, slightly broadened at apex, with a minute path at base, insititious, slightly to distinctly curved, smooth, except for slightly pruinose apex; concolorous with lamellulae (yellowish white, 3A2) above, black-brown towards the base. Forming sterile stipes and rhizomorphs.

Spores (8.5-)9.5-12.5 × 4.5-6.0(-6.2) µm, E = 1.6-2.5, Q = 2.0, (sub)fusoid to ellipsoid-fusoid, thin-walled, smooth, hyaline. Basidia 22-27 × 9.0-10.0 µm, 4-spored, (broadly) clavate. Basidioles 16-27(-31) × 4.0-12.0 µm, clavate, cylindrical, often fusoid. Cheilocystidia of two types: 1. broom cells of the Rotalis-type, (8.0-)14-23 × (4.5-)7.0-13 µm, clavate, broadly clavate, (sub)vesiculose, thin- to slightly thick-walled (0.5 µm) at base, thick-walled above, ± hyaline, thick-walled parts pale yellowish-greyish, projections up to 1.5(-2.0) µm long, pale yellowish-greyish; 2. lageniform to fusoid, often rostrate, obtuse to subcapitate, 23-33 × 5.0-9.0 µm, ± thin-walled, hyaline to pale yellowish greyish. Pleurocystidia present, scattered, similar to cheilocystidia of the type two. Hyphae ± cylindrical, thin- to slightly thick-walled, branched or with lateral (sometimes to subcoralloid) projections, smooth or minutely incrusted, hyaline, up to 9.0 µm wide. Pileipellis a hymeniderm, made up of clavate, ellipsoid to vesiculose broom cells of the Rotalis-type, 13-25 × 7.0-15(-20) µm, thin-walled at base, thin- to thick-walled (up to 3.0 µm) above, warts ± narrowly conical, subacute to acute, up to 1.5(-2.0) µm long, thin-walled cells subhyaline to pale brownish with yellow-brown to yellow-grey projections, thick-walled ones dark (yellow-)brown in KOH. Pileocystidia 17-25 × 5.0-9.0 µm, lageniform to fusoid, often rostrate, obtuse to subcapitate, thin- to mostly slightly thick-walled, smooth or with some projections in basal parts, subhyaline, yellow-grey to yellow-brown in KOH. Stipitipellis a cutis, of parallel, cylindrical, thick-walled (up to 1.5 µm), diverticulate, up to 5.0(-6.0) µm wide hyphae, brown in KOH; diverticulae up to 4.0 × 1.0 µm, cylindrical to conical, obtuse to subacute, thin- to slightly thick-walled, pale brown to dark (yellow-)brown in KOH. Caulocystidia absent. Clamp-connections present in all tissues. Chemical reactions: Neither spores nor all tissues dextrinoid or amyloid.

Ecology: Growing on dead stem of a liana and dead leaves and especially petioles of *Mumulopsis* in a montane rain forest.

Distribution: Known from Benin and Rwanda.

Studied specimens from tropical Africa: Benin, Tanugu, Atacora prov., Choutes de Tanugu, 8 Sept. 1997 leg. V. Antonín B97.171 (BR 101209-38). – Rwanda, road Butare-Cyangugu, km 94, Forest de Rugege, 31 Aug. 1974 leg. J. Rammeloo JR 4433 (holotype, GENT).

Marasmius minutoides is characterised by having a small sulcate pileus coloured dark brown at centre, paler at margin and in sulci, rather large spores, two types of cheilocystidia, both pleuro- and pileocystidia, and lacking caulocystidia. It belongs to sect. *Hygrometrici* Kühner.

The similar *Marasmius minutus* Peck, known from Northern Hemisphere (Europe, North America, Far East), has a non-hygrophanous, not translucently striate, pale red coloured pileus with darker centre, almost free to narrowly adnexed, vein-like lamellae, smaller spores [6.0-9.5 × (2.0-)2.7-4.0(-5.0) µm], pileipellis made up of two types of cells and developed caulocystidia (Antonín & Noordeloos 1993); *M. corbariensis* (Roum.) Singer has a larger (1-7 mm broad), glabrous, only slightly grooved pileus, closer lamellae (L = 10-14), longer stipe (8-30 mm), smaller spores [(8.0-)8.5-10 × 3.5-5.0(-5.5) µm] and lacks pileocystidia; it is widely distributed in Mediterranean Europe and North Africa once it was reported from tropical Africa from the former Zaire (Democratic Republic of Congo, Hendrickx 1948). *Marasmius parviconicus* Pegler (Pegler 1982) from Zambia has a pale brown pileus (but darker at centre and over the sulci), only one type of cheilocystidia (fusoid), and lacks pileocystidia. According to the type revision by Pegler (1966), a North African

(Tunisian) species *M. kroumirensis* (Pat.) Sacc. & Syd. has a uniformly fuscous, broadly umbonate pileus, reddish brown stipe, smaller basidia (16.5-19.5 × 5-6 µm), only one type of cheilocystidia, pleurocystidia but lacks pileocystidia (according to Pegler the type material is in an extremely poor condition and he has not found any spores). However, the same author (Pegler 1986) compared it with *M. micraster* Petch having two types of cheilocystidia.

According to Desjardin & Horak (1997), *M. fishii* G. Stevenson & G. M. Taylor differs especially in having a glabrous, uniformly coloured pileus, larger spores (11.5-13 × 6.5-7.0 µm) and by the absence of pleuro- and pileocystidia; *M. exustoides* Desjardin & E. Horak has a glabrous pileus, plicate only at the margin, lacks pleurocystidia and has larger pileocystidia (30-50 × 10-20 µm); *M. micraster* Petch has a glabrous, rusty brown to sooty brown pileus becoming orange to pale orange brown when dry (but yellowish brown to blackish brown and paler in sulci, Pegler 1986, Petch 1948), larger basidia and lacks pleuro- and pileocystidia. *Marasmius ilicis* Singer, from South America, has an orange-brown to chestnut brown pileus, sometimes pale to saffron orange in sulci and at the margin and smaller spores (6.7-9.5 × 3.5-5 µm); also *M. exustus* Berk. & M.A.Curtis. has smaller spores (5.5-9.2 × 3-4.5 µm, Singer 1976).

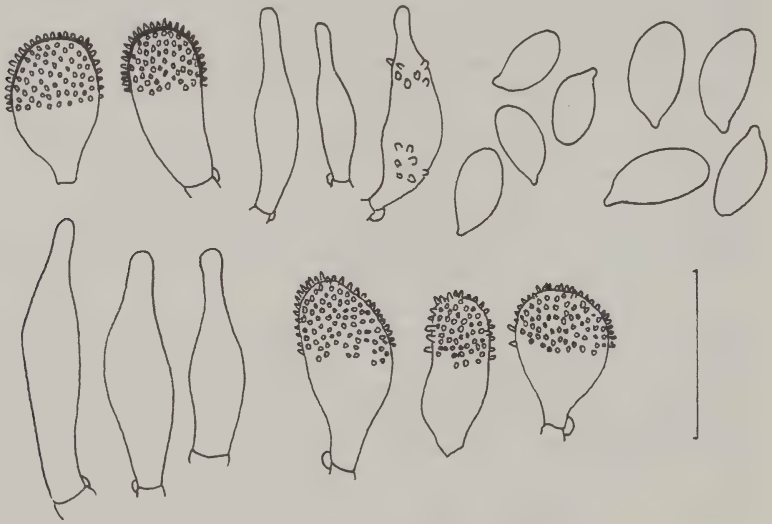
***Marasmius minutoides* var. *angustisporus* Antonín var. nov.**

A varietate typica sporis angustis et basidiis brevibus et angustis differt.
HOLOTYPUS: Benin, prov. Oueme, Agongo, 17. VIII. 1997 leg. V. Antonín B97.44 (holotypus in herbario BR 101098-24 asservatur).

Pileus 1-2 mm broad, almost campanulate-convex when young, then convex to applanate-convex when old, crenulate at sometimes slightly translucent margin, distinctly sulcate, pubescent, hygrophanous; dark brown (7F4) when young, pallescent up to yellow-brown towards margin, remaining dark brown at centre, yellowish-brownish colour remains also in sulci. Lamellae distant, L = 7-8, l = 0(-1), broadly adnate; yellowish white (c. 3A2), edge entire, concolorous, slightly pubescent. Stipe 11-13 × up to 0.5 mm, filiform, insititious, smooth, glabrous, slightly pruinose at apex, slightly lustrous, whitish to slightly brownish above, dark brown (7F7) towards base.
Spores (9.0-)9.5-11(-11.5) × 3.7-4.5(-5.0) µm, E = 2.0-2.9, Q = 2.5, fusoid to ellipsoid-fusoid, thin-walled, smooth, hyaline. Basidia 18-23 × 6.5-8.5 µm, 4-spored, clavate. Basidioles 11-25 × 4.0-9.0 µm, fusoid, clavate, often (sub)rostrate. Cheilocystidia of two types: 1. broom cells of the Rotalis-type, 12-25 × 9.0-17 µm, clavate, broadly clavate, vesiculose, thin-walled at base, slightly thick-walled above (up to 1.5 µm), ± hyaline, projections up to 1.5(-2.0) µm long, thick-walled parts and projections pale yellowish-greyish; 2. lageniform to fusoid, often rostrate, obtuse to subcapitate, 26-32 × 6.5-10.0 µm, ± thin-walled, smooth, hyaline to pale yellowish greyish. Pleurocystidia present, similar to cheilocystidia of the type two. Hyphae ± cylindrical, often irregular to branched, ± slightly thick-walled, smooth to incrusted, hyaline to pale yellowish, up to 10 µm wide. Pileipellis a hymeniderm, made up of broom cells of the Rotalis-type, 13-25 × 8.0-20 µm, clavate, ellipsoid, globose to vesiculose, ± thin-walled below, thin- to slightly thick-walled (1.0-1.5 µm) above, thin-walled parts ± hyaline, thick-walled ones pale yellow-grey-brown in KOH, warts up to 1.5(-2.0) µm long, cylindrical to conical, subacute to acute, warts pale yellow-grey-brown in KOH. Pileocystidia 20-25 × 5.0-7.0 µm, lageniform to fusoid, often rostrate, obtuse to subcapitate, thin- to slightly

thick-walled, smooth or with some projections in basal parts, hyaline to brownish in KOH. Stipitipellis a cutis, of parallel, cylindrical, thick-walled, diverticulate, up to 5 µm wide hyphae, with dark yellow-brown to brown walls in KOH; diverticulae up to 3.0 × 1.0 µm. Caulocystidia absent. Clamp-connections present in all tissues. Chemical reactions: Neither spores nor all tissues dextrinoid or amyloid.
Ecology: On dead leaves of *Raffia*, in a marshy forest with dominating *Raffia*.
Distribution: Known only from the type locality in Benin.
Studied specimens from tropical Africa: Benin, Oueme prov., Agongo, 17 Aug. 1997 leg. V. Antonín B97.44 (holotype, BR 101098-24).

Marasmius minutoides var. *angustisporus* differs from the type variety in having narrower spores, and shorter and narrower basidia.



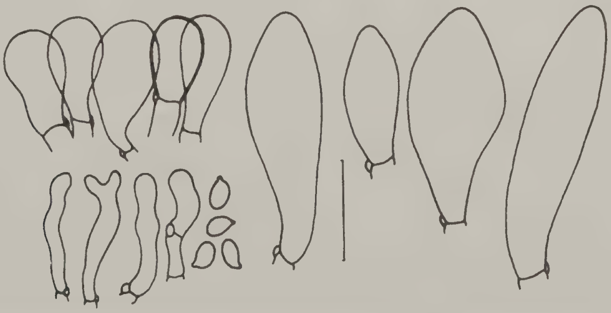
Marasmius minutoides (holotype): pileipellis cells and pileocystidia, spores of var. *angustisporus* and of var. *minutoides* (from upper left to upper right) and two types of cheilocystidia (lower). Except for spores, all structures belong to both varieties. Scale bar = 20 µm.

Marasmius muramwyanensis Antonín sp. nov.

Pileo usque 45 mm lato, junio conico, maturitate late conico, centro obtuse umbonato, glabro, membranaceo, centro luteolo-griseo-brunneo, margine pallido, luteolo-griseo vel griseo-aurantiaco. Lamellis confertis, L = 35-40, l = 3, luteis vel luteo-albidis, acie concolore. Stipite 40-65 × 3 mm, cylindraceo, non-insititio, pubescente, ad basim fibrilloso vel fibrilloso-squamoso, apice albido vel cremeo, ad basim ochraceo vel brunneo-aurantiaco. Sporis 5.0-6.2 × 2.9-3.7 µm, ellipsoideis, late ellipsoideis, hyalinis, tenuitunicatis et inamyloideis vel crassitunicatis et dextrinoideis. Basidiis tetrasporis; crassobasidiis praesentibus. Cheilocystidiis 10-23(-35) × 4.0-7.0 µm, clavatis, (sub)-

cylindraceis vel subfusiformibus, tenuitunicatis. Pleurocystidiis 19-55 × 8.5-17 µm, cylindraceis, clavatis, fusiformibus, refractis, tenuitunicatis. Pileipellis hymeniformis, e cellulis clavatis, 16-35 × (7.0-)10-19 µm, laevibus. Pileocystidiis absentibus. Caulocystidiis frequentibus, 22-42 × (4.0-)8.0-13 µm, cylindraceis, clavatis vel subfusiformibus. Hyphis dextrinoideis, fibulatis. Ad lignum putridum *Cupressi*.
HOLOTYPUS: Burundi, prov. Muramwya, Teza, 20. XII. 1978 leg. J. Rammeloo 6148 (holotypus in herbario BR 11905-71 asservatur).

Pileus up to 45 mm broad, conical when young, later broadly conical, with small broad umbo, with regular, sometimes slightly undulate margin, glabrous, membranaceous, up to 1 mm thick, brown-beige (± 6E5) at centre, paler towards margin, beige or greyish orange (± 5B4). Lamellae close, c. 35-40, l = 3, free, convex to convex-concave, up to 2 mm broad, not intervenose, pale yellow to yellowish white (3A2 to 4A2), with entire or weakly undulate concolorous edge. Stipe 40-65 × 3 mm, cylindrical, sometimes compressed, sometimes twisted, mealy to finely pubescent, finely fibrillose to very finely flibrillose-squamulose towards base, very pale, sordid white to cream at apex, ochraceous to brownish orange (5A4) at base. Context up to 1 mm in pileus, brownish under pileipellis, pale beige otherwise, with rather soil reminding smell and indistinct smell.
Spores 5.0-6.2 × 2.9-3.7 µm, E = 1.5-1.9, Q = 1.7, ellipsoid to broadly ellipsoid, both thin-walled and non-dextrinoid and slightly thick-walled and dextrinoid, smooth. Basidia 27-28 × 5.8-6.2 µm, 4-spored, clavate; crassobasidia present. Basidioles 11.5-27 × 2.5-7.0 µm, clavate, cylindrical. Cheilocystidia 10-23(-35) × 4.0-7.0 µm, clavate, (sub)cylindrical, subfusoid, sometimes septate, often irregular, thin-walled. Pleurocystidia 19-55 × 8.5-17 µm, variable, often voluminous, cylindrical, clavate, fusoid, often subrostrate, hyaline, thin-walled, with a refractive contents. Hyphae cylindrical to subinflated, thin- to slightly thick-walled (often in subpileipellis), pale yellowish, up to 12 µm wide. Pileipellis a hymeniderm, made up of 16-35 × (7.0-)10-19 µm, clavate, thin- to slightly thick-walled smooth cells, with yellowish to brownish walls in KOH. Stipitipellis a cutis, of parallel, cylindrical, slightly thick-walled, incrusted, up to 7.0 µm wide hyphae. Caulocystidia 22-42 × (4.0-)8.0-13 µm, adpressed to erect, clavate, cylindrical, subfusoid, obtuse, thin- to slightly thick-walled. Clamp-connections present in all tissues. Chemical reaction: Hymenium and pileipellis cells non-dextrinoid; hyphae and a part of spores dextrinoid.



Marasmius muramwyanensis (holotype): pileipellis (upper left), cheilocystidia and spores (lower left), pleurocystidia (right). Scale bar = 20 µm.

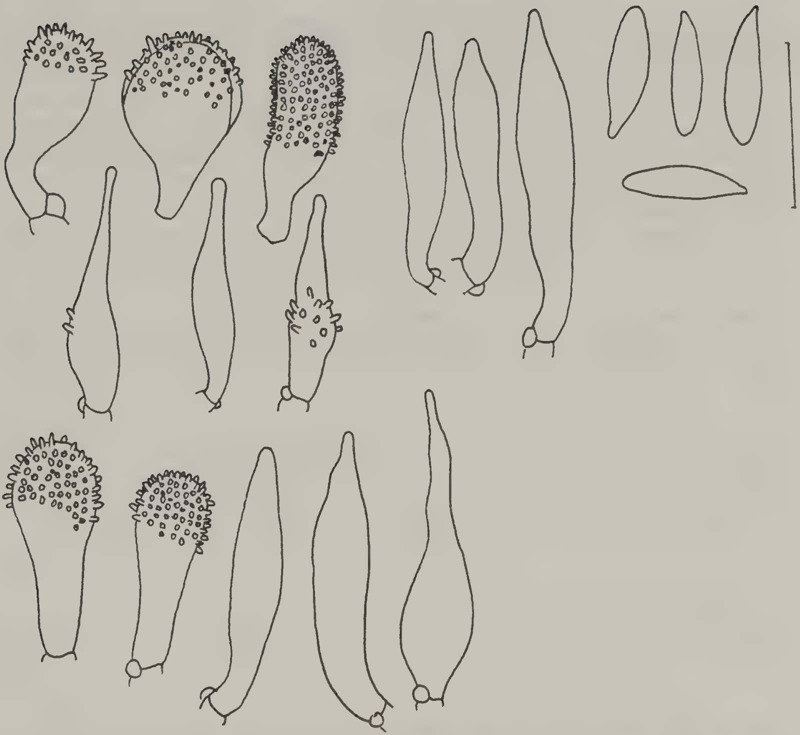
Ecology: Gregarious, on dead wood of a cultivated *Cupressus*.
Distribution: Known only from the type locality in Burundi.
Studied specimens from tropical Africa: Burundi, Muramwya prov., Teza, 20 Dec. 1978 leg. J. Rammeloo 6148 (BR 11905-71, holotype).

Marasmius muramwyanensis is characterised by having a comparatively large pileus, close lamellae, finely pubescent stipe, small spores, and by the presence of pleurocystidia which differs from cheilocystidia, and the presence of caulocystidia. It belongs to sect. *Globulares* Kühner.

Macroscopically close species seem to be *M. witteanus* Singer and *M. goossensiae* Beeli. However, *M. witteanus* (holotype BR!) differs especially by its smaller pileus, densely cespitose stipe, pleurocystidia similar to cheilocystidia and by the absence of caulocystidia; *M. goossensiae* (lectotype BR!) has a differently coloured pileus, larger spores, larger cheilo- and pleurocystidia, and lacks caulocystidia. Among other tropical species with small spores (less than 10 µm long) and developed pleurocystidia, *M. jodocodos* Henn. from tropical Africa especially differs in having violaceous coloured carpophores and a smooth stipe (Pegler 1977). *Marasmius ochraceus* Berk. & Broome has a large pileus (30-80 mm), thicker stipe (60-110 × 4-7 mm) and cheilocystidia are absent, *M. calvus* Berk. & Broome has a campanulate pileus, larger cylindrical to subfusoid spores (8-10.5 × 2.7-3.5 µm), smaller refractive cystidia (30-35 × 6-8 µm) and cheilocystidia are absent (Pegler 1986). *Marasmius phlebodiscus* Desjardin & E. Horak has a pale beige to tan coloured pileus with net-like wrinkles at the centre, a densely longitudinally fibrillose stipe, and only fusoid pleurocystidia (Desjardin & Horak 1997). *Marasmius riparius* Singer from Argentina has a differently coloured pileus (like *M. oreades*), white then cinnamomeous stipe, larger (8.2-10 × 4.8-5.5 µm) ellipsoid-fusoid spores and smaller cystidia (40-44 × 8-9 µm); cheilocystidia are absent (Singer 1976). *M. silvicola* Singer has a larger (17-95 mm broad), deeply cinnamomeous to ochraceous brownish pileus, larger stipe (20-118 × 1.5-7 mm), and larger spores (4.5-8.3 × 2.5-4.3 µm) (Singer 1976).

Marasmius nyikae Antonín sp. nov.

Pileo usque 4 mm lato, convexo-hemisphaerico vel late conico, sulcato, subtiliter tomentoso, griseo- vel nigro-brunneo. Lamellis distantibus, L = ± 10. Stipite usque 30 longo, filiforme, insititio, junio subtiliter pruinoso, maturitate glabro, ad basim nigro-brunneo, apicem pallidiore. Sporis (11.6-)12.5-16.2 × 3.5-4.2 µm, ellipsoideis vel fusiformibus, hyalinis, inamyloideis. Basidiis tetrasporis. Cheilocystidiis 1. e cellulis cheilocystidiorum Marasmii rotalis similibus, 17-31 × 7.0-11.5 µm, clavatis vel late clavatis et 2. e cellulis lageniformibus vel fusiformibus, 27-35 × 6.0-9.0 µm. Pleurocystidiis similibus cheilocystidiorum typi 2. Pileipellis hymeniformis, 1. e cellulis clavatis, ellipsoideis vel vesiculosis, cellulis hymenodermatis Marasmii rotalis similibus, (13-)14.5-32 × 8.0-13.5(-15.5) µm, clavatis vel subvesiculosis et 2. e cellulis clavatis vel late clavatis, laevibus constructa. Pileocystidiis 20-29 × 4.5-7 µm, lageniformibus vel fusiformibus, rostratis, laevibus vel nonnumquam ad basim cum diverticulis infrequentis. Caulocystidiis absentibus. Hyphis indextrinoideis, fibulatis. Ad folia putrida.
HOLOTYPUS: Malawi, area protecta Nyika, Gîte Chelinda, 4. XII. 1981 leg. J. Rammeloo 7646 (holotypus in herbario BR 011987-56 asservatur).



Marasmius nyikae (holotype): pileipellis cells and pileocystidia (upper left), pleurocystidia (upper middle), spores (upper right) and two types of cheilocystidia (lower). Scale bar = 20 µm.

Pileus up to 4 mm broad, convex-hemispherical to broadly conical (paraboloid), sulcate, finely tomentose, grey- to black-brown, sometimes (when carpophores) radially striped. Lamellae distant, L = ± 10, narrow, may be with a dark edge. Stipe up to 30 mm long, filiform, insititious, finely pruinose when young, then glabrous and smooth, lustrous, paler at apex, black-brown towards base; forming sterile stipes and rhizomorphs. [According to a photo and an exsiccatum.]

Spores (11.6-)12.5-16.2 × 3.5-4.2 µm, Q = 3.1-4.6, E = 3.6, fusoid to narrowly ellipsoid-fusoid, thin-walled, smooth, hyaline. Basidia 24-32 × 6.9-9.2 µm, 4-spored, clavate. Basidioles 15-31 × 6.9-9.2 µm, clavate, (sub)cylindrical, subfusoid. Cheilocystidia of two types: 1. broom cells of the Rotalis-type, 17-31 × 7.0-11.5 µm, clavate to broadly clavate, thin- to very slightly thick-walled above, hyaline at base, brownish above; projections variable in number, up to 1.0 µm long, subacute, less frequently obtuse, brown in KOH; 2. lageniform or fusoid, 27-35 × 6.0-9.0 µm, thin- to slightly thick-walled, rostrate, subacute, rarely acute, obtuse or subcapitate. Pleurocystidia similar to cheilocystidia of the type two, 24-36 × (5.5-)6.0-7.5 µm, lageniform, awl-form or (sub)fusoid, sometimes subcapitate, thin-, rarely slightly thick-walled. Hyphae cylindrical, often branched (sometimes up to coralloid), hyaline, smooth, up to 8.0 µm wide. Pileipellis a hymeniderm, made up of more types of cells: 1. broom cells of the Rotalis-type, (13-)14.5-32 × 8.0-13.5(-15.5) µm, clavate, broadly clavate to

(sub)vesiculose, thin- to thick-walled (especially at top), thick-walled parts brown in KOH; projections warty-like or digitate, obtuse to (sub)acute, up to 1.5 μm long, brown in KOH; 2. scattered thick-walled cells of the similar size and colour as the type one, but (almost) smooth. Pileocystidia 20-29 × 4.5-7.0 μm, lageniform or (sub)fusoid, rostrate, often (sub)capitate, thin- to slightly thick-walled, mostly smooth, rarely with some digitate projections at basal part. Stipitipellis a cutis, of cylindrical, parallel, thick-walled (up to 1.0 μm), up to 5 μm wide hyphae, with brown walls in KOH; stipitipellis hyphae diverticulate at apex when young, smooth towards base; diverticulae up to 4.0 × 1.0 μm, digitate, obtuse. Caulocystidia absent. Clamp-connections present in all tissues. Chemical reactions: Neither spores nor all tissues dextrinoid or amyloid.
Ecology: Growing on dead leaves in a region at altitude 2300 m.
Distribution: Known only from Malawi.
Studied specimens from tropical Africa: Malawi, Nyika National Park, Gîte Chelinda, 4 Dec. 1981 leg. J. Rammeloo 7646 (holotype, BR 011987-56, K4270).

Marasmius nyikae is characterised by having a dark coloured, sometimes striped pileus, large fusoid to ellipsoid-fusoid spores, two types of cheilocystidia and the presence of pleuro- and pileocystidia. Such a combination of microfeatures was not found in the literature in any other species. It belongs to sect. *Hygrometrici* Kühner.

Marasmius tshopoensis Antonín sp. nov.

Pileo 60 mm lato, ± applanato, sulcato, glabro, membranaceo, centro luteo-ochraceo, cum sulcis ochraceis et margine cremeo. Lamellis distantibus, L = 17, l = 0, liberis, intervenosis, luteo-albidis, acie concolore. Stipite 85 × 2.5 mm, cylindraceo, non-insititio, glabro, obscure brunneo. Sporis (19-)21-26 × 4.8-6.0 μm, clavatis, anguste fusiformibus, hyalinis, inamyloideis. Basidiis tetrasporis. Cheilocystidiis (12.5-)15.5-28.8 × 6.2-11.5(-21) μm, clavatis, subvesiculosis, cylindraceis, regularibus vel irregularibus, lobatis vel subrostratis, ± tenuitunicatis. Pleurocystidiis absentibus. Pileipellis hymeniformis, e cellulis clavatis vel vesiculosis, 15.5-25.5 × 10-19(-24.5) μm, laevibus. Pileocystidiis absentibus. Caulocystidiis absentibus. Hyphis dextrinoideis, fibulatis. Ad folia putrida.
HOLOTYPUS: Democratic Republic of Congo, Tshopo prov., Nabij Kisangani, insula Congolo, 14. IV. 1984 leg. B. Buyck 1394 (holotypus in herbario BR 11762-25 asservatur).

Pileus 60 mm broad, somewhat applanate, strongly sulcate, glabrous, membranaceous, with straight entire margin, rather uniformly coloured, never striped, yellow-ochraceous at centre, ochraceous on sulci, striae paler, almost cream coloured towards margin, ochraceous when dry. Lamellae very distant, L = 17, l = 0, free, strongly intervenose, about 8 mm broad, yellowish white (2A2), with concolorous entire edge. Stipe 85 × 2.5 mm, cylindrical, slightly twisted, glabrous, but locally with arachnoid network of small fibrills, hollow, smooth, dark brown (7F4); with rich white basal tomentum. Context thin, yellowish white (2A2), not changing colour; with slightly sweet taste and smell. Spore print white.
Spores (19-)21-26 × 4.8-6.0 μm, E = 3.8-4.8, Q = 4.3, clavate, narrowly fusoid, rarely septate, thin-walled, hyaline. Basidia c. 33 × 9.0 μm, 4-spored, clavate. Basidioles 15.5-35.5 × 3.0-10.0 μm, clavate, cylindrical or subfusoid. Cheilocystidia (12.5-)15.5-28.8 ×

6.2-11.5(-21) µm, variable in shape, clavate, subvesiculose, cylindrical, sometimes irregular, lobed or subrostrate, rarely subcoralloid, ± thin-walled, hyaline. Pleurocystidia absent. Trama hyphae ± cylindrical, thin- to slightly thick-walled (in subpileipellis), up to 11 µm wide. Pileipellis a hymeniderm, made up of 15.5-25.5 × 10-19(-24.5) µm, clavate to vesiculose, thin- to slightly thick-walled, smooth cells. Stipitipellis a cutis, of parallel, cylindrical, slightly thick-walled, up to 6.0 µm wide hyphae. Caulocystidia absent; scattered adpressed to erect terminal cells present. Clamp-connections present in all tissues. Chemical reaction: Spores and hymenium non-dextrinoid; hyphae dextrinoid, pileipellis cells sometimes slightly dextrinoid.

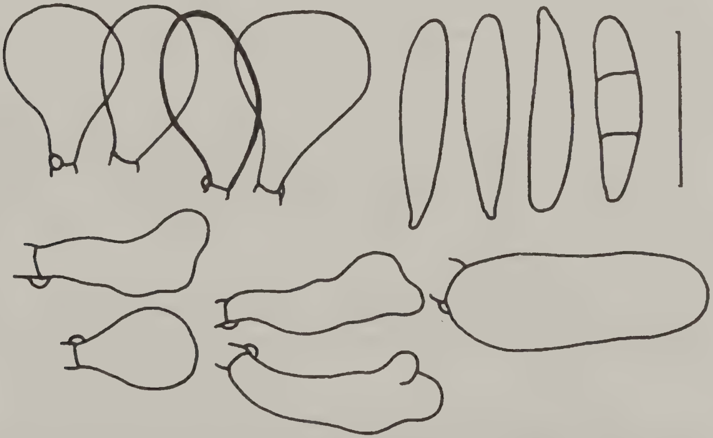
Ecology: On fallen decaying leaves in humus in a secondary rain forest with relicts of the primary rain forest.

Distribution: Known only from the Democratic Republic of Congo till now.

Studied specimens from tropical Africa: Democratic Republic of Congo, Tshopo prov., Nabij Kisangani, Congolo island, 14 Apr. 1984 leg. B. Buyck 1394 (BR 11762-25).

Marasmius tshopoensis is characterised by rather large carpophores, with pileus sulcate, yellow-ochraceous at centre, ochraceous on sulci and almost cream towards the margin, distant, distinctly intervenose pale yellowish lamellae, lacking lamellulae, large spores, rather small cheilocystidia, and the absence of pleuro- and caulocystidia. It belongs to sect. *Globulares* Kühner.

Marasmius brunneolus (Beeli) Singer (holotype BR!) is the closest related species. It differs in having whitish coloured pileus often in sulci, presence of lamellulae, smaller spores (15.5-25.5 × 3.8-5.4 µm), and more uniformly clavate cheilocystidia.



Marasmius tshopoensis (holotype): pileipellis cells (upper left), spores (upper right) and cheilocystidia (lower). Scale bar = 20 µm.

Among other species with strongly intervenose lamellae, *Marasmius rhyssophyllus* Mont. has a smaller (25 mm) yellow pileus, yellow lamellae and yellow or white stipe, and smaller spores 7.0-8.3 × 3.3-3.8 µm; *M. ditopotrama* Singer has a light brownish grey pileus with otter brown or dark spadiceous striae, brownish or grey lamellae, a pruinose grey stipe, smaller spores 7-9 × 4.5-4.8 µm and larger cheilocystidia; *M. poromycenoides* Singer has a dark purple coloured pileus and stipe and smaller spores (5.7-6.2 × 3.5-3.8 µm); the very variable *M. cohortalis* Berk. (more varieties are described) has smaller spores (up to 8.5 µm long) in all varieties (Dennis 1970, Singer 1976).

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A NEW SPECIES OF PITHOMYCES

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Abstract: A new species of the genus *Pithomyces* on *Musa wilsonii* (Musaceae) is described and illustrated: *P. musae* on *Musa wilsonii*. Specimens examined is deposited in the Herb of Plant Pathology of Shandong Agricultural University (HSAUP).

Key words: *Pithomyces musae*

Pithomyces musae X. G. Zhang & Y. M. Wu, sp. nov. Fig.1

Coloniae pulvinatae vel effusae, pallide brunneae. Mycelium superficiale ex hyphis ramosis, septatis, subhyalinis vel stramineis, laevibus, 1.5-3.5 μ m crassis, reticulatis compositum. Conidiophora singularia ex lateralibus hypharum oriunda, simplicia, recta vel flexuosa, cylindrica, pallide straminea, laevia, 9.5-21.5 μ m longa, 1.0-2.0 μ m crassa. Conidia singularia in apice conidiophori oriunda, recta vel curvata, ellipsoidea, oblonga vel clavata, brunnea vel fusca, laevia, 14.0-40.0 μ m longa, 5.0-7.0 μ m lat, transverse 1-7-septata, septa longitudinalia nulla, ad septa transversa distincte constricta.

Hab. In foliis vivis *Musae wilsonii* (Musaceae), Nanning, Guangxi Provincia, Sina, 21 VII 1999, X. G. Zhang, HSAUP 991085, Holotypus.

Colonies pulvinate or effuse on PCA, blackish brown. Mycelium superficial, composed of a network of branched, septate, subhyaline or straw coloured, smooth-walled, hyphae 1.5-3.5 μ m wide. Conidiophores borne singly, laterally and irregularly on the hyphae, simple, straight or flexuous, cylindrical, pale straw coloured, smooth, 9.5-21 μ m long, 1.0–2.0 μ m wide. Conidia formed singly as blown-out ends at the apex of each conidiophore, straight or curved, ellipsoid, oblong or clavate, brown to dark blackish brown, smooth, 14-40 μ m long, 5.0-7.0 μ m wide in the broadest part, with 1-7 transverse and no longitudinal septa, distinctly constricted at septa. The conidia usually secede by fracture of the wall of the conidiophores and each conidium carries away with it most of the conidiophore.

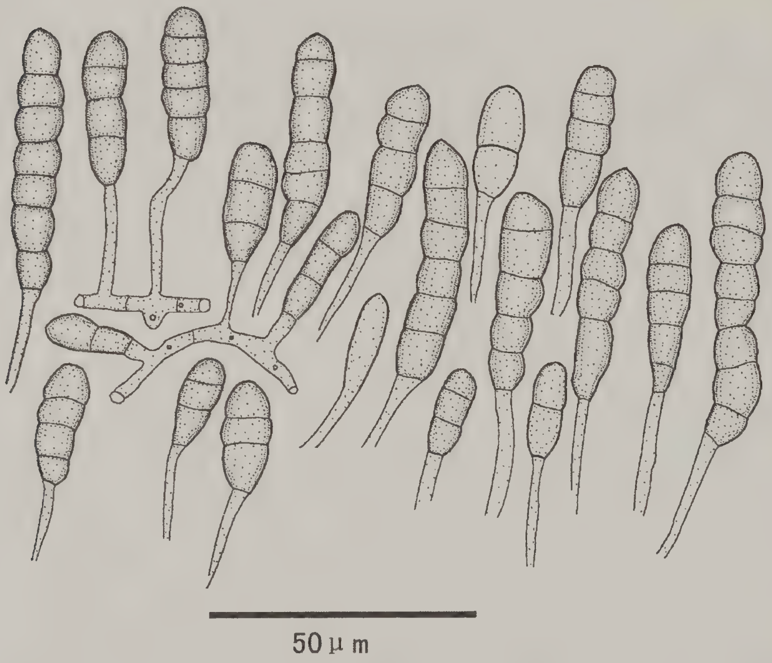

Fig.1 Conidia and conidiophores of *Pithomyces musae*.

Pithomyces musae differs from all other taxa classified in this genus in its conidial characters: size, shape, smooth wall, and the fact that the conidium carries away with it most of the conidiophore (Ellis, 1960, 1965, and 1971).

Specimens examined and strains studied: on leaf spots of *Musa wilsonii* (Musaceae), and isolated from leaf spots of *Musa wilsonii* (Musaceae), respectively. Holotypus: HSAUP 991085, Nanning, Guangxi Province of China.

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The author is greatly indebted to Prof B. Kendrick for reviewing the manuscript.

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TUCKERMANELLA, A NEW CETRARIOID GENUS IN WESTERN NORTH AMERICA

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Abstract: The new genus *Tuckermanella* is described to accomodate the cetrarioid lichen species which have been referred to as the *"Cetraria fendleri* group," most of which have been placed more recently in the related genus *Tuckermannopsis*. New combinations are provided for the four previously described species, and two new species are described: *Tuckermanella arizonica* sp. nov. and *T. pseudoweberi* sp. nov.

Key words: lichen fungi, *Cetraria*, *Tuckermannopsis*, Arizona, Mexico

Introduction

Like much of the rest of the Parmeliaceae, the cetrarioid lichens have been gradually segregated into smaller and supposedly more natural genera (Randlane et al. 1997, Randlane & Saag, 1998). One of these down-sized genera, *Tuckermannopsis*, was itself rather broadly delimited until recently (Kärnefelt & Thell 2001). Among the species from the old genera *Cetraria* and *Tuckermannopsis* left unaccounted for, there are six North American species that form a morphologically and geographically well defined group, previously referred to as the "*Cetraria* (or *Tuckermannopsis*) *fendleri*" group. Two of these are previously undescribed species. I here propose recognition of a new genus, *Tuckermanella*, named in honor of the first American lichenologist, Edward Tuckerman, to accommodate these species.

Tuckermanella Essl. *gen. nov.*

Type species: *Tuckermanella weberi* (Essl.) Essl.

Thallus foliosus, prostratus, parvus vel mediocris, 0.5-4 (-7) cm latus, laciniae 0.3-1.5 (-3) mm latae; superficies superior fulvobrunneus, brunneus, olivaceus vel atrovirens, margine pseudocyphellata, superficies inferior albus vel fulvobrunneus, modice rhizinatus; apothecia marginalia vel submarginalia, ascosporae ellipsoideae vel ovoideae, 6-9.5 x 4-6 μm; pycnidia inferme vel modice emersa, submarginalia vel laminalia, pycnoconidia bifusiformia, 3.5-6.5 x 1 μm.

Thallus foliose, small to medium sized, prostrate or occasionally weakly ascendant, lobate; lobes elongate and linear to somewhat shorter and more rounded; upper surface

pale brown to brown, olive-brown or blackish green, with more or less conspicuous linear marginal pseudocyphellae; upper and lower cortex paraplectenchymatous; medulla white to off-white, or rarely (in one species) ochre-yellow; lower surface almost white to tan or pale brown, usually rather dull, moderately to rather sparsely rhizinate, the rhizines usually concolorous with the lower surface, simple or sparsely furcate. Apothecia with thalline exciple; asci clavate and 8-spored; ascospores: simple, hyaline, ovoid to more commonly ellipsoid, 6-9.5 x 4-6 µm. Pycnidia blackened, weakly emergent and broader than they are tall; conidia bifusiform, 3.5-6.5 x 1 µm. Secondary chemistry: fatty acids, depsides or depsidones.
Geography: montane temperate to tropical, endemic to North America. Substrate: bark (especially conifers) or wood.

Most of the species to be placed in *Tuckermanella* had been previously placed into *Tuckermannopsis*, and among the cetrarioid genera, it is with that genus that the closest comparison of characters must be made. The main differences between the two genera are summarized below:

Tuckermanella	***Tuckermannopsis***
Thalli usually small to occasionally mid-sized and narrow-lobed (0.5-2 mm), mostly prostrate	Thalli small to often mid-sized, broader-lobed (1-6 mm), often loosely ascendant
With more or less continuous marginal pseudocyphellae on lobes	Without pseudocyphellae, except sometimes on the irregular warts, papillae, or apothecial margins
Lower surface sparsely to moderately rhizinate, the rhizines more or less evenly distributed	Lower surface sparsely rhizinate, especially on ascendant parts
Pycnidia submarginal and laminal, immersed to weakly emergent, nearly always broader than they are tall	Pycnidia mostly marginal or submarginal, distinctly emergent, often as tall as they are broad, or taller
Ascospores mostly ellipsoid (rarely to ovoid), 6-9.5 x 4-6 µm	Ascospores subglobose to globose, 5-8 µm
Apparently endemic to North America (including Mexico), especially in the west	Broadly distributed in the Northern Hemisphere, with a single bipolar species
Only fertile (5) and isidiate (1) species known	Only fertile (4) and sorediate (3) species known

All chemical analyses were carried out using the various modifications (e.g. Culberson 1974, Culberson & Ammann 1979) of the standardized TLC methods first devised by Culberson & Kristinsson (1970). Using all three (or occasionally more) solvent systems, this technique still works exceedingly well to distinguish among and to identify the numerous phenolic products produced by lichens. However, for the precise identification of aliphatic substances like fatty acids, it has severe limitations. When studying a group of species or sometimes even a series of specimens within a species, varying numbers of fatty acids are detected and their Rf values are often inconsistent. The reports given in this paper, especially for the higher Rf fatty acids (e.g. lichesterinic, protolichesterinic), are therefore left uncertain.

Tuckermanella arizonica Essl. *sp. nov.*

Thallus foliosus, prostratus, parvus, brunneus vel fulvobruneus; apothecia numerosa, conglomerata; acida aliphatica continens.

Thallus foliose, up to 2 (rarely 3) cm in diam., more or less orbicular; lobes rounded-crenate to somewhat elongate, the edges becoming laciniate-papillate, 0.5-1.5 (-3) mm broad, flat to weakly pitted, sometimes weakly canaliculate, prostrate or weakly ascending; upper surface tan-brown to brown or occasionally dark brown, epruinose, dull or weakly shiny, frequently becoming irregularly papillate in mature areas, the papillae and the lobe edges with more or less conspicuous whitish pseudocyphellae; without soredia or isidia; upper and lower cortex paraplectenchymatous; medulla white; lower surface almost white to pale tan or pale brown, more or less smooth to weakly trabeculate or rugose, dull or weakly shiny near the periphery (rarely with a patchy white pruina), rhizines sparse but usually more or less scattered across the lower surface. Apothecia frequent and often becoming numerous and crowded, up to 3.5 mm in diameter, more or less concave or irregularly convex with age, margin smooth or becoming finely crenate-papillate, bearing pseudocyphellae on the papillae; ascospores ovoid to more usually ellipsoid, 6-8 x 4-5 μm. Pycnidia black, weakly emergent, submarginal and often laminal; conidia 5-6.5 x 1 μm, bifusiform.

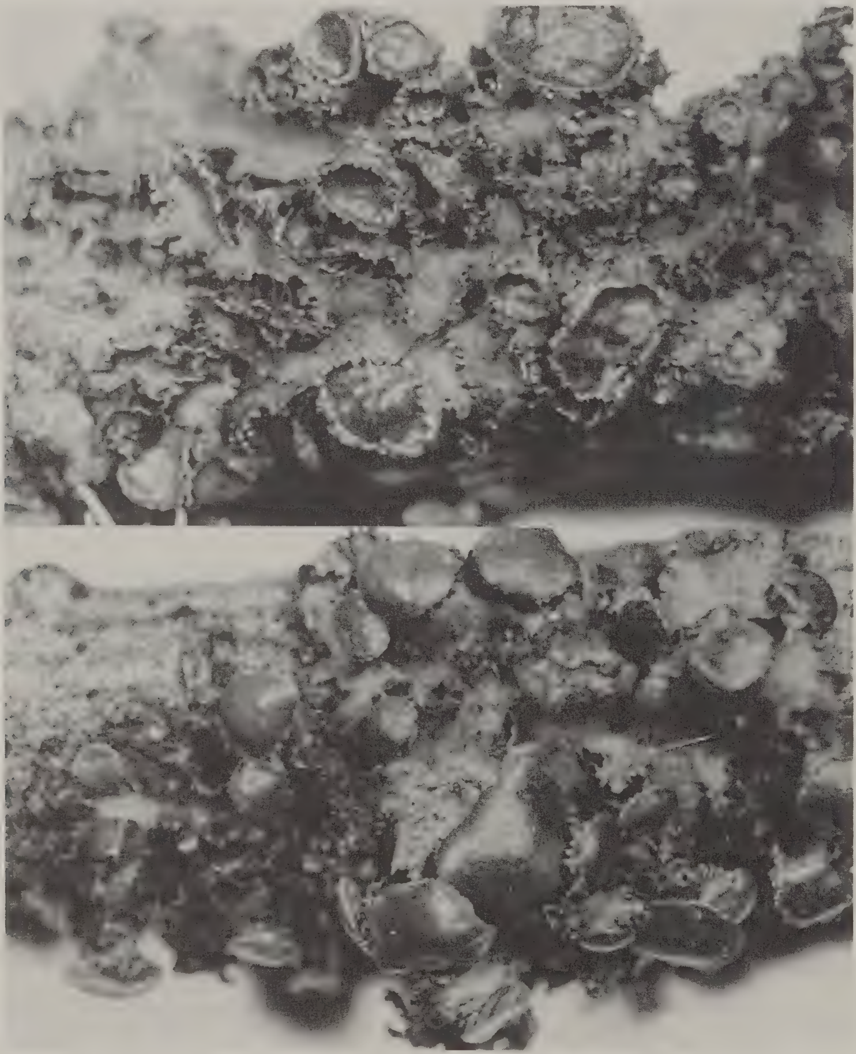
Chemistry: cortex and medulla all spot tests negative (medulla sometimes reacts CK+ pale yellow, slowly); producing 2-3 lichesterinic acid type fatty acids (high Rf).

Occurring on bark or wood (usually conifers), often on twigs. Known only from the mountains of Arizona and of Hidalgo and Chihuahua, Mexico, in western North America.

Type: Arizona. Greenlee Co.: Apache National Forest, Mogollon Rim along forest Rd 54, ca 5 km W of Hwy 191; 33°34.6'N, 109°23.1'W; ca. 2700 m elev.; fir-Doug fir-white pine forest; on white pine twigs; *Esslinger 15724* (ASU, holotype; TLE, US, isotypes).

This species might be mistaken for either of two North American species in the genus *Tuckermannopsis*, although neither is known to be sympatric with it. Specimens growing on larger branches or boles (rather than twigs) become larger & broader lobed, and might be mistaken for a compact specimen of *T. orbata* (Nyl.) M. J. Lai. It differs from that species by the smaller, more prostrate, loosely appressed or only weakly ascendant thallus. Also, the marginal whitish pseudocyphellae on lobe edges of *T. arizonica* are missing in *T. orbata*.

Thalli of *Tuckermanella arizonica* commonly grow on twigs, and these specimens are often smaller and more compact than those on boles or large branches, and they bear numerous crowded apothecia, thus bearing a superficial resemblance to *Tuckermannopsis sepincola* (Ehrh.) Hale, a northern species which has not been found in the Sonoran region. That species has clearly more ascendant lobes, even when young, and the lobe margin and thallus upper surface mostly remain smoother (not or weakly crenate, without papillae). Also, in *T. sepincola*, the pycnidia mostly occur directly on (or very near) the lobe margins, are distinctly emergent and often taller than they are broad (only ca. 50 μm broad). In *T. arizonica*, the pycnidia may be largely concentrated on or near the lobe margins, but laminal pycnidia are also common on occasional lobes or thallus regions. These pycnidia are black but are only weakly emergent (and often 2-3 times as broad as they are tall), unlike the distinctly emergent pycnidia of both *T. orbata* and *T. sepincola*.



Figures 1-2. Pieces of the holotype of *Tuckermanella arizonica*. Fig. 1. A thallus showing lobe form with conspicuous whitish margins (interpreted here as continuous marginal pseudocyphellae) and still-concave apothecia (x10). Fig. 2. A thallus with more crowded, convex apothecia (x8.5).

A few specimens which were more prostrate and with narrower and flatter lobes than usual, look almost like *Tuckermanella weberi*, which is clearly distinguished by positive spot tests in the medulla and less conspicuous marginal pseudocyphellae.

Selected Specimens Examined: U.S.A. Arizona. Apache Co.: Apache National Forest, Mt. Baldy Wilderness area, 33°55'30"N, 109°31'W, 3000 m, *Ryan & Nash 26887* (ASU); Cochise Co.: Chiricahua Mtns., N slope of Monte Vista Peak, 31°49'45"N, 109°18'30"W, 2770 m, *Nash 21046* (ASU); Coconino Co.: along trail to Mt. Humphreys timberline, 35°20'15"N, 111°41'W, 3400 m, *Nash 35211* (ASU); Graham Co.: Shannon Camp, Pinaleno Mtns., 32°39'N, 109°51'W; Greenlee Co.: Hannagan Meadows, along U.S. 666, 2770 m, *Nash 7704* (ASU). Mexico. Chihuahua: along rte. 16, ca. 20 km W of Basaseachic, 28°19'N, 108°15'W, 2200 m, *Nash 37707* (ASU); Hidalgo: El Chico National Park, W-facing hillside above Presa Jaramillo, 20°10'N, 98°44'W, 2880m, *Nash 38059* (ASU).

Tuckermanella coralligera (W. A. Weber) Essl. *comb. nov.*

Basionym: *Cetraria fendleri* var. *coralligera* W. A. Weber, Lichens of the Chiricahua Mountains, Arizona. Univ. of Colorado Studies, Ser. Biology 10: 11 (1963). Synonyms: *Tuckermannopsis coralligera* (W. A. Weber) W. A. Weber in Egan, Bryologist 94: 399 (1991). *Cetraria coralligera* (W. A. Weber) Hale, Bryologist 70: 414. 1967.

Tuckermanella fendleri (Nyl.) Essl. *comb. nov.*

Basionym: *Platysma fendleri* Nyl., Synopsis Methodica Lichenum I, p. 309 (1860). Synonyms: *Tuckermannopsis fendleri* (Nyl.) Hale in Egan, Bryologist 90: 164 (1987). *Cetraria fendleri* (Nyl.) Tuck., Genera Lichenum p. 33 (1872). *Parmelia fendleri* Tuck. in Nyl. (nomen nudum), Mém. Soc. Sci. Nat. Cherbourg 5: 105 [1858 ('1857')].

Tuckermanella pseudoweberi Essl. *sp. nov.*

Thallus similis *T. weberi*, sed thallo magnore et acida caperatica continens.

Thallus foliose, up to 5 (-7) cm in diam., usually more or less orbicular; lobes somewhat elongate but branched and partly contiguous, 0.6-1.2 mm broad, flat to weakly concave, prostrate; upper surface tan-brown to brown, sometimes with a slight reddish brown or olive-brown cast on lobe ends, more or less smooth at the periphery but becoming irregularly rugose and sometimes developing folioles inward, the lobe edges bordered with distinctive whitish, linear pseudocyphellae, epruinose, dull or weakly shiny at the periphery; without soredia or isidia; upper and lower cortex paraplectenchymatous; medulla white in part, but partly or totally off-white to pale ochre-yellow; lower surface pale to darker tan or almost brown in oldest parts, smooth to weakly rugose, dull; rhizines sparse, simple, concolorous with the lower surface or darkening. Apothecia infrequent, up to 3 mm in diam., the margin crenate to papillate, bearing pseudocyphellae on the crenae or papillae; ascospores 7-9.5 x 5-5.5 μm, ellipsoid. Pycnidia black, immersed to weakly emergent, mostly submarginal and laminal; conidia 4-6 x 1 μm, bifusiform.
Chemistry: cortex all spot tests negative, medulla PD-, K+ pale to darker violet or K- in pure white parts, C-; producing caperatic acid and an unidentified quinonoid pigment.
Occurring on wood (or bark?) of conifers; known only from the type specimen, from Chihuahua, Mexico.

Type: Mexico. Chihuahua: along rte 16 ca. 20 km W of Basaseachic, S facing ridge with large rhyolite outcrop on ridge crest, oak-pine-juniper-manzanita (28°19'N, 108°15'W); 2200 m elev.; on dead log of conifer (*Juniperus*?), *Esslinger 13680* (ASU, holotype; Herb. Esslinger, isotype).

The brown color and distinctive marginal pseudocyphellae on the lobe margins are much like *T. weberi*, but *T. pseudoweberi* is larger and grosser, and has a very different chemistry, producing caperatic acid (and a quinonoid pigment) instead of the olivetoric acid or physodic acid characteristic of that species.

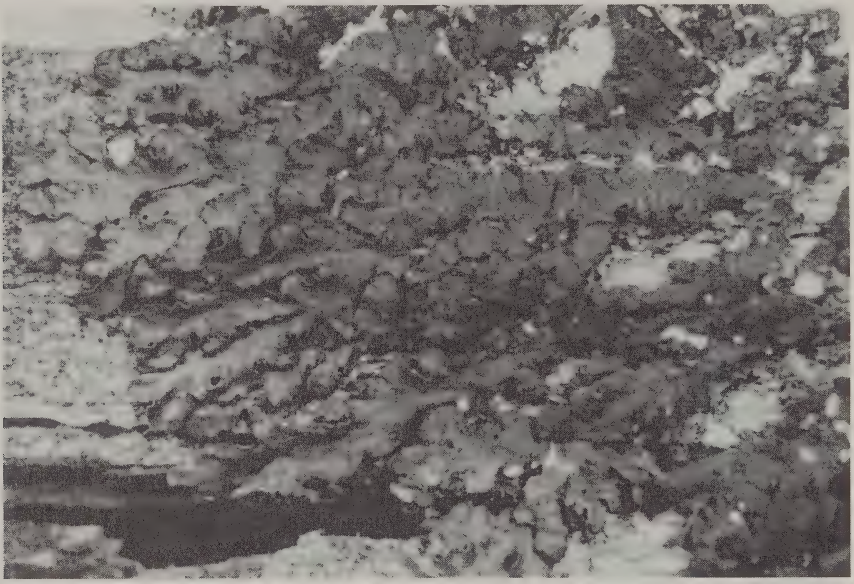


Figure 3. Part of the holotype of *Tuckermanella pseudoweberi*, x7.5.

Tuckermanella subfendleri (Essl.) Essl *comb. nov.*
Basionym: *Cetraria subfendleri* Essl., Mycologia 65: 610 (1973).

Tuckermanella weberi (Essl.) Essl. comb. nov.
Basionym: *Cetraria weberi* Essl., Mycologia 65: 607 (1973).

Key to the species of *Tuckermanella*

1. Thallus isidiate . . . . ***Tuckermanella coralligera***
1. Thallus lacking isidia (but perhaps variously papillate, laciniate or foliolate) 2
    2. Medulla with at least one positive spot test (C+ or KC+ rose-red or K+ pale violet) 3
    2. Medulla all spot tests negative 4
3. Medulla C+ rose-red (olivetoric acid) or C- & KC+ rose-red (physodic acid) . . . . ***Tuckermanella weberi***
3. Medulla C-, KC-, K+ pale to darker violet (caperatic acid) . . . . ***Tuckermanella pseudoweberi***

4. Thallus color predominantly a shade of brown (pale brown to brown or reddish brown) 5
4. Thallus color predominantly a shade of green (olive-green to olive-black) . . 6
5. Thallus small (mostly < 2 cm); apothecia usually numerous and crowded; often on conifer twigs; producing lichesterinic type fatty acids . . ***Tuckermanella arizonica***
5. Thallus larger (up to 7 cm); apothecia frequent but not crowded; on lignum; producing caperatic acid (usually with a quinonoid pigment) . . ***Tuckermanella pseudoweberi***
6. Thallus small (usually less than 2.5 cm); northern (S to northern Mexico); producing lichesterinic acid type fatty acids . . . . ***Tuckermanella fendleri***
6. Thallus commonly becoming larger (up to 5 cm); southern (Oaxaca, Mexico); producing caperatic acid . . . . ***Tuckermanella subfendleri***

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TWO NEW SPECIES OF THE GENUS ENTOLOMA FROM SOUTH INDIA

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Abstract:
Two new species of the genus *Entoloma*, viz., *E. nilgirisiensis* and *E. indica*, collected from Nilgiris district, Tamil Nadu, India, are described.

Key Words: Agaricales, Entolomataceae.

During the course of our studies on South Indian Agaricales two interesting species of the genus *Entoloma* (Fr.) Kummer have been collected. They are described as new species in this paper. The colour terminology used is that of Kornerup & Wanscher (1978). The specimens are deposited in the herbarium at University of Madras Botany Laboratory (Herb.MUBL). Manjula (1983) in her revised list of Indian agarics has listed 2 species of the genus *Entoloma* and Manimohan *et al.*, (1995) have reported 21 more species from Kerala, India.

Entoloma nilgirisiensis Natarajan and Ravindran, sp. nov. Figs. 1-3

Pileus 25-65mm latus, expansus obtuse umbonatus, centro brunneo–aurantiacus, margine brunneus, siccus, margine striatus, fibrillosus. Lamellae liberae vel leviter adnexae, primo flavidae, postea roseal, confertae, margine concoloratae, integrae. Stipes 60-130mm longus, 2-5mm crassus, centralis, cylindrico-clavatus, brunneo-flavidus, siccus, fibrillosus, cavus, fragilis; caro tenui-tunicata, hyalina. Sporae 7.5 - 11.5 x 6-7.5 µm, ellipsoideae, 5-6 angulatae. Basidia 26-34 x 7.5-9 µm, clavata, 4-sporigera. Margo lamellarum fertilis. Cystidia nulla. Trama hymenophori regularis, hyalina. Pileipellis ex hyphis repentibus, hyalinis compositus. Fibulae nulla. Ad terram, singularis, Nilgiris, India. Holotypus: in Herb. MUBL, No.3175.

Pileus 25-65 mm diam., expanded with obtuse umbo, surface brownish orange (6C4) towards centre and light brown (6D4) towards margin, hygrophanous, dry, striate near margin, fibrillose, at disc fibrillose to squamulose. Lamellae free to slightly adnexed, yellowish when young, becoming pink, crowded; edge concolorous, entire. Stipe 60-130 x 2-5 mm, central, cylindric to subclavate, brownish yellow (5C8) to orange white (6A2), dry, coarsely fibrillose, hollow, fragile; context hyaline, thin-walled. Spores 7.5-11.5 x 6-7.5 (9.5±1 x 6.5±0.5) µm, Q=1.5, ellipsoid, 5-6 angled. Basidia 26-34 x 7.5-9 µm, clavate, 4- spored. Lamella edge fertile. Cheilocystidia and pleurocystidia none. Hymenophoral trama regular, hyaline. Pileipellis a cutis of repent, entangled, thin-walled, hyaline hyphae, not gelatinized. Clamp connections absent.

On soil, single.
Snowdon, Nilgiris, Tamil Nadu, India, 14th October 1998, Coll., C. Ravindran. Herb., MUBL, No.3175. (Type).

The robust tricholomatoid habit and the narrow hyphae in the pileipellis place this species in subgenus *Entoloma* (Noordeloos, 1988). The size (65mm), shape and colour (brownish orange) of the pileus, adnexed lamellae and absence of clamp-connections are the characteristic features of this species. It is closely related to both *E. clavistipes* Horak from Papua New Guinea (Horak, 1980) and *E. subquadratum* Hesler from North Carolina (Hesler, 1967). But *E. clavistipes* differs by its larger argillaceous pileus (-90mm), wider stipe (4-10mm), adnate to emarginate lamellae and smaller spores (8.5-9.5 x 6-6.5µm). The conic to campanulate pileus, smaller fruitbody and the presence of clamp connections make *E. subquadratum* distinct. Hence the present collection is described as a new species.

Entoloma indica Natarajan & Ravindran, sp. nov. Figs. 4-8

Pileus 20-30 mm latus, convexus, centro depressus, albidus, pellucido-striatus, glaber. Lamellae adnato-subdecurrentes, primo albae, postea roseal, confertae, margine concolorate, integrae. Stipes 30-40mm longus, 1-2.5mm crassus, centralis, cylindricus, aequalis, cavus, glaber. Sporae 7-11.5 x 7–11 µm, cuboideae. Basidia 43-47.5 x 10-12 µm, clavata, 4-sporigera. Margo lamellarum sterilis, cheilocystidia 16-29 x 7.5–20 µm, cylindrico-clavata. Pleurocystidia nulla. Trama hymeophori regularis. Pileipellis ex hyphis repentibus, hyalinis, compositus. Caulocystidia 28-75 x 11-20 µm, cylindrico-clavata, tenui-tunicata, hyalina. Hyphae fibulatae. Ad terram, singularis, Nilgiris, India. Holotypus: In Herb. MUBL, No.3176.

Pileus 20-30 mm diam., convex, depressed at centre, surface whitish, radially fibrillose, or velvety, hygrophanous, translucently striate, dry, membranous. Lamellae adnate to subdecurrent, first whitish, later turning deep pink, crowded; edge concolorous, entire. Stipe 30-40 x 1-2 mm, central, cylindrical, fibrous, equal, hollow, glabrous, shiny, white and tomentose at base; context whitish, thin walled. Spores 7-11.5 x 7-11 (8.5 ± 0.5 x 8.2 ± 0.6) µm Q=1, cuboid, thick-walled, with single guttule. Basidia 43-47.5 x 10-12 µm, clavate, 4-spored. Lamella edge sterile. Cheilocystidia 16-29 x 7.5-20 µm, cylindric to clavate, hyaline, thin-walled. Pleurocystidia none. Hymenophoral trama regular. Subhymenial layer well developed, hyaline, with clamp connections. Pileipellis a cutis of repent, entangled, thin-walled, hyaline hyphae. Caulocystidia present, 28-75 x 11-20 µm, cylindric to clavate, hyaline, thin-walled. Clamp-connections present.

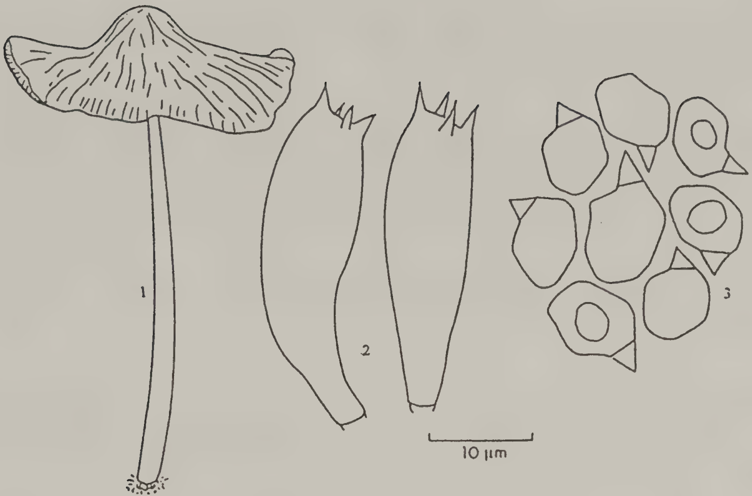

Fig. 1-3: ***Entoloma nilgirisiensis*** Natarajan & Ravindran, sp. nov., 1. Habit x ½, 2. Basidia, 3. Basidiospores.

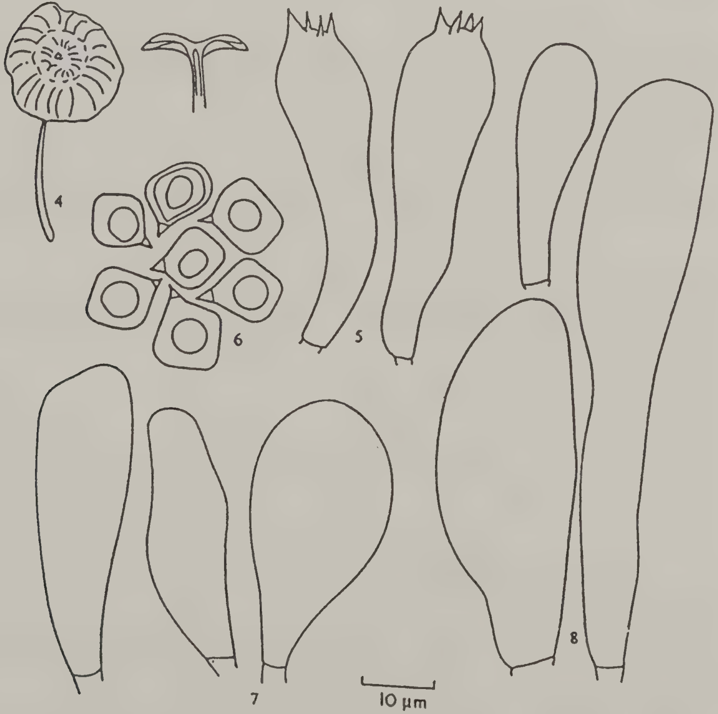

Fig. 4-8: ***Entoloma indica*** Natarajan & Ravindran, sp. nov., 4. Habit x ½, 5. Basidia, 6. Basidiospores, 7. Cheilocystidia, 8. Caulocystidia.

On soil, single.
Kolakumbai, Nilgiris, Tamil Nadu, India, 17th October 1998. Coll., C. Ravindran. Herb. MUBL, No.3176 (Type).

The whitish clitocyboid habit, convex pileus with depressed disc, pellucid striations and adnate to subdecurrent lamellae place this species in subgenus *Alboleptonia* (Noordeloos, 1988). Whitish pileus, subdecurrent lamellae, and presence of cheilocystidia and caulocystidia are characteristic features of this species. It comes close to *E. talisporum* Corner & Horak from Papua New Guinea (Horak, 1975). But *E. talisporum* differs by its smaller white-yellow pileus, larger stipe, smaller spores and absence of cheilocystidia and caulocystidia. Hence the present species is described as new.

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A NEW RUST FUNGUS (UREDINALES) ON PENAEACEAE: UREDO SARCOCOLLAE ON SALTERA SARCOCOLLA*

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ABSTRACT: *Uredo sarcocollae* (Uredinales) is described as a new species. It is the first known rust fungus from the Penaeaceae, which are endemic in South Africa. The host plant, *Saltera sarcocolla*, grows in the Fynbos in the south-western Western Cape Province.

KEYWORDS: Biodiversity, Fynbos, South Africa, Western Cape

INTRODUCTION

The BIOTA (Biodiversity Monitoring Transect Analysis) Southern Africa project is a long term, multidisciplinary project that aims at monitoring biodiversity along a rainfall gradient and different land management systems from the Cape of Good Hope in South Africa to the North of Namibia. Surveying and mapping rust fungi within this project, we found the uredinial stage of a rust fungus on *Saltera sarcocolla* (L.) Bullock in the BIOTA-observatory at Olifantsbos in the Cape Peninsula National Park. As far as could be established there is no other known rust fungus either from the genus *Saltera* Bullock or from the family Penaeaceae (Doidge 1950; Crous, Phillips & Baxter 2000). The fungus is therefore described as new.

MATERIALS AND METHODS

Drawings and spore measurements (50 spores) of *Uredo sarcocollae* were obtained from herbarium material. Freehand sections were heated in "Hoyer's fluid" (Cunningham 1972). To determine the presence of obscure germ pores on urediniospores, spores were mounted in "Wittmann's embedding medium" (Kreisel & Schauer 1987). All preparations were observed with a Carl Zeiss microscope with bright field and phase contrast. For scanning electron microscopy, air-dried fragments of rust-infected leaves were placed onto double-sided adhesive tape fixed to an observation stub, spattered with gold-palladium and observed with a Cambridge Stereoscan 250 Mk–2. The nomenclature of the host *Saltera sarcocolla* conforms to Dahlgren (1968).

Uredo sarcocollae **Mennicken, Berndt & Oberwinkler, sp. nov.** (Figs. 1–3)
Pycnia, aecia et telia ignota. Uredinia amphigena, subepidermalia, usque ad 0.5 mm diam., saepe paraphysata et strato hypharum tecta. Urediniosporae obovoideae, pyriformes vel ellipsoideae, 19–27 (–29) x 14–18 (–20) µm, pariete hyalino ad dilute brunneo, 1–1.5 µm crasso, 4–6 poris germinationis obscuris, sparsis, si 4 saepe approx. aequatorialibus praeditae.
In foliis *Salterae sarcocollae* (L.) Bullock (Penaeaceae).

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* Part 211 of the series "Studies in Heterobasidiomycetes".

Pycnia, aecia, and telia unknown.

Uredinia amphigenous, subepidermal, scattered, irregularly rupturing pustules small, up to 0.5 mm wide, roundish, cinnamon-brown, spots surrounding pustule up to 2 mm wide, discoloured dark auburn to dark violet, not clearly margined on the host leaves, with an undefined layer of presumably dead fungus cells between epidermis and urediniospores. Paraphyses in several uredinia colourless to yellowish-brown, short, the wall 1–5 µm thick apically, becoming progressively thinner towards the base.

Urediniospores variable in shape, obovoid, pyriform or ellipsoid, 19–27 (–29) x 14–18 (–20) µm, echinulate, borne singly on short pedicels, spore wall uniformly about 1–1.5 µm thick, colourless to yellowish-brown, germ pores obscure, indistinct, when seen in "Wittmann's embedding medium", 4 to 6, scattered, sometimes when 4 germ pores were present, they were often more or less equatorial, with hyaline papillae that are weakly developed.

On the leaves of *Saltera sarcocolla* (L.) Bullock (Penaeaceae).

Etymology. Named after the host plant, *Saltera sarcocolla*.

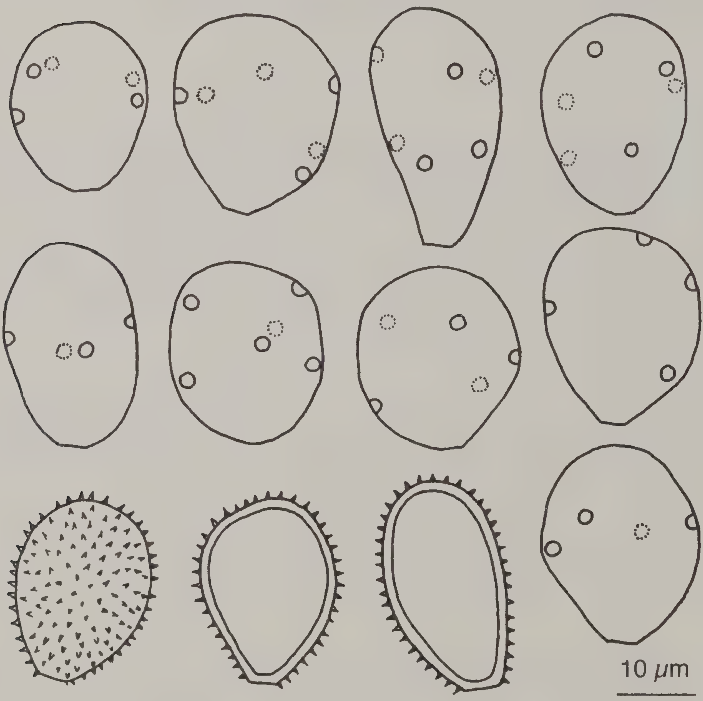

Fig. 1. Urediniospores of *Uredo sarcocollae*. Holotype. In the upper spores the echinulation was not delineated.

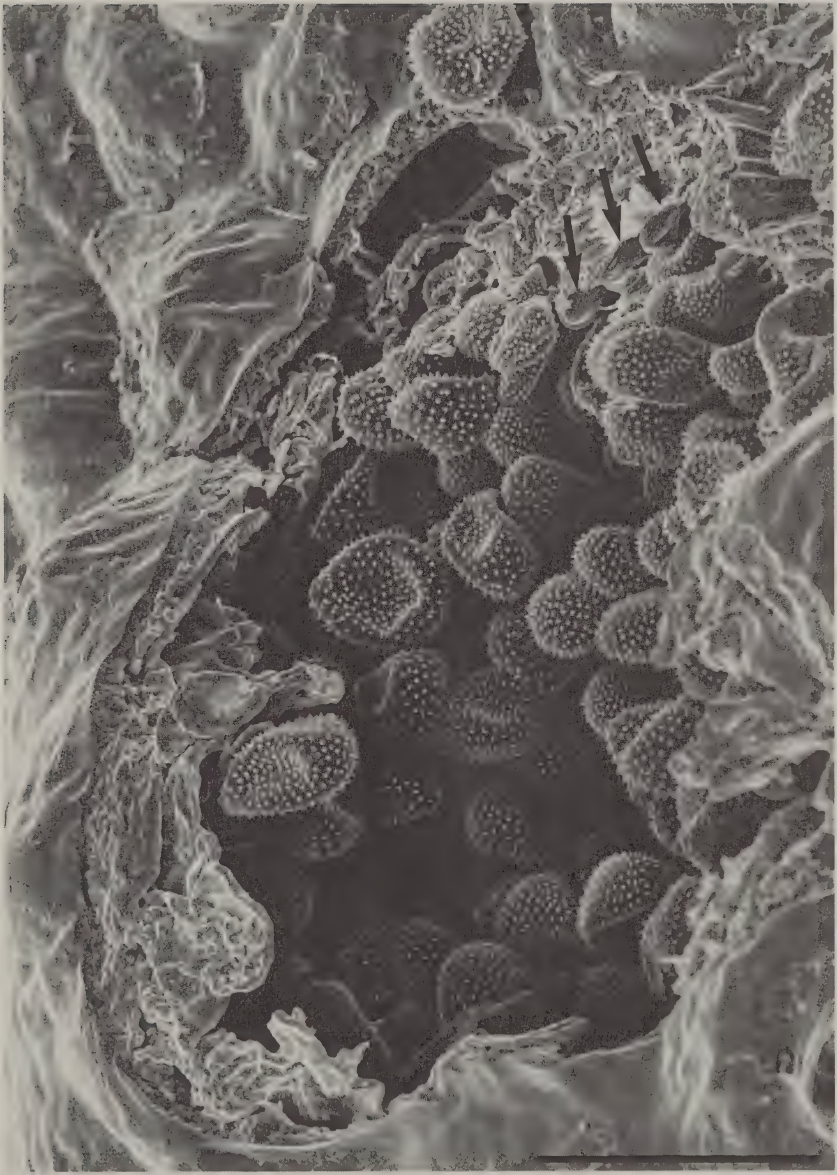

Fig. 2. SEM micrograph of an uredinium with urediniospores of *Uredo sarcocollae*. Holotype. The apical parts of the paraphyses (arrows) can be seen. Scale bar = 40 μm

SPECIMENS EXAMINED:

- South Africa, Western Cape Province, Cape Peninsula National Park, BIOTA-observatory at Olifantsbos, on *Saltera sarcocolla* (L.) Bullock, S 34° 15' 45'', E 18° 23' 60'', 17.XI.2001, leg. Mechthilde Mennicken. HOLOTYPE PREM, ISOTYPE B.
- South Africa, Western Cape Province, Caledon District, W Palmiet River, Kopje S slope, on *Saltera sarcocolla* (L.) Bullock (as *Sarcocolla tetragona* (Berg.) Salter resp. *Penaea tetragona* Berg.), 01.X.1956, leg. Rolf Dahlgren & Bo Peterson. PARATYPE B.

Another specimen found in B has not been examined because of the scantiness of the infection:

- South Africa, Western Cape Province, Betty's Bay, Kogelberg Nature Reserve (as Koogelsberg Reserve), on *Saltera sarcocolla* (L.) Bullock (as *Sarcocolla tetragona* (Berg.) Salter resp. *Penaea tetragona* Berg.), 23.IX.1963, leg. H. & E. Walter.

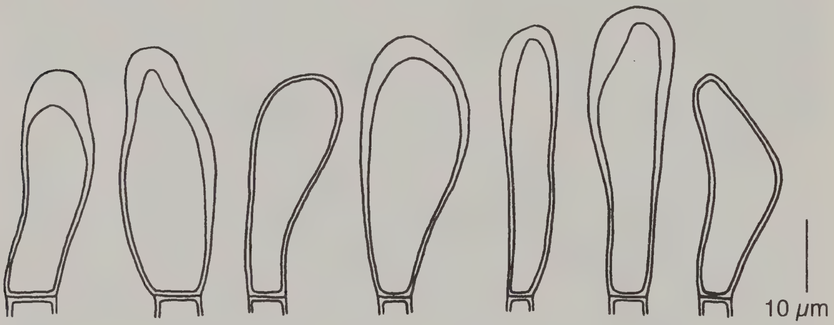

Fig. 3. Paraphyses of *Uredo sarcocollae*. Holotype.

The outer part of the uredinial cavity is lined with a layer of collapsed and tangled hyphae. It could not be determined whether this layer belongs to a distinct peridial structure or is a remnant of the uredinial primordium.

The inconspicuous paraphyses (Figs. 2, 3) could not be found in all uredinia.

The observation of the number and the distribution of the germ pores (Fig. 1) was very difficult. We were only successful to demonstrate the number and position of the germ pores reliably in the holotype using "Wittmann's embedding medium". The different intensity of colouration of the germ pores and the surrounding areas is perishable. Germ pores could not be seen in the older urediniospores of the paratype with the exception of germ pores in optical sections.

The host family Penaeaceae, which belongs to the Rosidae-Myrtales, contains 7 genera and 23 species and is endemic in the southern and south-western Western Cape Province and the southern Eastern Cape Province of South Africa. The monotypic host genus *Saltera* is endemic to the south-western Western Cape Province. (Bredenkamp 2000).

Saltera sarcocolla "grows in sand or sometimes in rock fissures on flat or shelving, seldom rather steep, slopes of sandstone mountains of the Table Mountain Series. It is mainly concentrated to the coastal areas, but has been found as far inland as in the French Hoek Pass [Franschhoek Pass] and the mountains above Genadendal. The altitude ranges between almost the sea level and about 1.000 m. The vegetation is always a typical rather sparse fynbos." (Dahlgren 1968).

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The authors thank Pedro Crous for pre-submission review of the manuscript, Michael Weiss for help with the Latin diagnosis, the curator of B, Robert Vogt for the loan of rust-infected leaves of *Saltera sarcocolla* (L.) Bullock, Karl-Heinz Hellmer and Friedhelm Albrecht for performing the scanning electron microscopy, and Sheila and Brian Longman for comments on the English text. The study was made possible by the Federal Ministry of Education and Research in Germany through the sourcing of the BIOTA Southern Africa project. The Western Cape Nature Board and the Cape Peninsula National Park are gratefully acknowledged for issuing a research permit.

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A LIST OF DISCOMYCETES IN CHINA. SUPPLEMENT II [*]
（中国盘菌名录，续二）

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Abstract: This is the continuation of the previous list of discomycetes in China and its supplement I.

Key words: Addition, corrections, *Lachnum orinocense*, *Parascutellinia*

More discomycetes have been added to the Chinese records since “A list of discomycetes in China” and its “Supplementary list — I” were published (Zhuang 1998a, 2001). Corrections for names in the previous lists are provided.

SUPPLEMENTARY LIST — II

Albotricha longispora Raitv. 长孢白毛盘菌 (Zhuang 2002)
Anthracobia maurilabra (Cooke) Boud. 暗唇炭生盘菌 (Wang 2001b)
Anthracobia melaloma (Alb. & Schwein.: Fr.) Arnould 黑缘炭生盘菌 (Wang 2001b)
Arachnopeziza colachna W.Y. Zhuang & Z.H. Yu 粒毛蛛盘菌 (Yu & Zhuang 2002)
Botryotinia draytonii (Buddin & Wakef.) Seaver 德雷顿葡萄孢盘菌 (Leather & Hor 1969, Kohn 1979)
Botryotinia squamosa (Vienn.-Bourg.) Dennis 鳞状葡萄孢盘菌 (Leather & Hor 1969)
Boubovia micholsonii (Massee) Spooner 米氏布博维盘菌 (Zhuang 2002)
Cistella cf. *hungarica* (Rehm) Raitv.（参照）匈牙利小毛盘菌 (Zhuang *et al*. 2002)
Coccomyces illiciicola H.Y. Liu, Y.R. Lin & C.T. Xiang 八角生齿裂菌 (Liu *et al.* 1999)
Coccomyces occultus Y.R. Lin & Z.Z. Li 隐齿裂菌 (Lin *et al*. 1999)
Crocicreas fuscum (W. Phillips & Harkn.) S.E. Carp. 棕色胶被盘菌 (Wang & Pei 2001)
Crocicreas nivale (Rehm) S.E. Carp. 雪白胶被盘菌 (Whitton 1999)
Encoelia cubensis (Berk. & M.A. Curtis) Iturriaga, Samuels & Korf 古巴散胞盘菌 (Zhuang & Yu 2001)
Hydnocystis japonica (Tak. Kobay.) Trappe 日本腔囊块菌 (Wang & Pei 2001)

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Hymenoscyphus adlasiopodium Z. Wang (Wang & Pei 2001)
= *Hymenoscyphus lasiopodium* (Pat.) Dennis (Synonymy based on type examination)
Hymenoscyphus cf. *consobrinus* (Boud.) Hengstm. （参照）相关膜盘菌 (Zhang & Zhuang 2002)
Hymenoscyphus fucatus (W. Phillips) Baral & Hengstm. 双极毛膜盘菌 (Zhang & Zhuang 2002)
Hymenoscyphus menthae (W. Phillips) Baral 薄荷膜盘菌 (Zhang & Zhuang 2002)
Hymenoscyphus cf. *populneus* (Velen.) Svrček （参照）杨膜盘菌 (Zhang & Zhuang 2002)
Hymenoscyphus sinicus W.Y. Zhuang & Y.H. Zhang 中国膜盘菌 (Zhang & Zhuang 2002)
Lachnellula laricis (Cooke) Dharne 落叶树长生盘菌 (Zhuang 2002)
Lachnellula rattanicola J. Fröhl. & K.D. Hyde 藤长生盘菌 (Fröhlich & Hyde 2000)
Lachnum abnorme (Mont.) J.H. Haines & Dumont var. *sinotropicum* Z.H. Yu & W.Y. Zhuang 异常粒毛盘菌中国热带变种 (Yu & Zhuang 2002)
Lachnum bannaense Z.H. Yu & W.Y. Zhuang 版纳粒毛盘菌 (Yu & Zhuang 2002)
Lachnum controversum (Cooke) Rehm 芦苇粒毛盘菌 (Ye & Zhuang 2002)
Lachnum cf. *fushanese* M.L. Wu & J.H. Haines （参照）福山粒毛盘菌 (Ye & Zhuang 2002)
Lachnum hyalopus (Cooke & Massee) Spooner 禾本科粒毛盘菌 (Yu & Zhuang 2002)
Lachnum lanariceps (Cooke & W. Phillips) Spooner 树蕨粒毛盘菌 (Yu & Zhuang 2002)
Lachnum mapirianum (Pat. & Gaillard) M.P. Sharma var. *mapirianum* 马地粒毛盘菌原变种 (Yu & Zhuang 2002)
Lachnum mapirianum var. *sinense* Z.H. Yu & W.Y. Zhuang 马地粒毛盘菌中国变种 (Yu & Zhuang 2002)
Lachnum pritzelianum (Henn.) Spooner var. *pritzelianum* 蒲葵粒毛盘菌原变种 (Yu & Zhuang 2002)
Lachnum pritzelianum var. *longipilosum* Z.H. Yu & W.Y. Zhuang 蒲葵粒毛盘菌长毛变种 (Yu & Zhuang 2002)
Lachnum privum Z.H. Yu & W.Y. Zhuang 五指山粒毛盘菌 (Yu & Zhuang 2002)
Lachnum pseudosclerotii Z.H. Yu & W.Y. Zhuang 假斯氏粒毛盘菌 (Yu & Zhuang 2002)
Lachnum cf. *stipulicala* J.H. Haines（参照）叶鞘生粒毛盘菌 (Yu & Zhuang 2002)
Lachnum tengii W.Y. Zhuang 邓氏粒毛盘菌 (Zhuang 2002)
Lambertella tengii W.Y. Zhuang 邓氏兰伯特盘菌 (Zhuang 2002)
Lambertella yunnanensis (S.H. Ou) W.Y. Zhuang & Y.H. Zhang 云南兰伯特盘菌 (Zhuang & Zhang 2002)
Lophodermium implicatum Y.R. Lin & Z.S. Xu 纠丝散斑壳 （Lin *et al*. 2001）
Lophodermium validum Y.R. Lin, Z.S. Xu & K. Li 强壮散斑壳 （Lin *et al*. 2001）
Mollisia cf. *caesia* (Fuckel) Sacc. （参照）浅灰软盘菌 (Wang & Pei 2001)
Mollisia cf. *melaleuca* (Fr.) Sacc. （参照）黑白软盘菌 (Wu & Wang 2000)
Niptera excelsior (P. Karst.) Dennis 高盆盘菌 (Wong 2000)
Octospora cf. *humosa* (Fr.) Dennis （参照）土生八孢盘菌 (Wang & Pei 2001)
Orbilia delicatula (P. Karst.) P. Karst. 怡人圆盘菌 (Wang & Pei 2001)

Orbilia luteorubella (Nyl.) P. Karst. 黄红圆盘菌 (Tsui *et al*. 2000)
Parascutellinia arctespora (Cooke & W. Phillips) T. Schum. 近盾盘菌 (This paper, Schumacher 1988, Dissing *et al*. 2000)
Perrotia atrocitrina (Berk. & Broome) Dennis 黑黄钝囊盘菌 (Zhuang *et al*. 2002)
Peziza cf. *pseudoviolaceae* Donadini （参照）假紫盘菌 (Wang & Pei 2001)
Proliferodiscus dingleyi Spooner 丁氏层出盘菌 (Zhuang *et al*. 2002)
Psilachnum hainanense W.Y. Zhuang 海南短毛盘菌 (Zhuang *et al*. 2002)
Psilopezia deligata (Peck) Seaver 白缘滑盘菌 (Wang & Pei 2001)
Pulvinula miltina (Berk.) Rifai 红垫盘菌 (Wang & Pei 2001)
Sphaerosporella taiwania Y.Z. Wang 台湾小球孢盘菌 (Wang 2001a)
Sphaerosporella brunnea (Alb. & Schwein.) Svrček & Kubčka 小球孢盘菌 (Wang 2001b)
Sorokinella appendiculospora J. Fröhl. & K.D. Hyde 小条孢盘菌 (Fröhlich & Hyde 2000)
Stictis carnea Seaver & Waterston 肉色点盘菌 (Whitton *et al*. 1999)
Stromatinia gladioli (Drayton) Whetzel 菖蒲座盘菌 (Leather & Hor 1969)
Terriera breve (Berk.) P.R. Johnst. 短扁盘菌 (Fröhlich & Hyde 2000)
Trichophaea donglingensis Z. Wang (Wang & Pei 2001)
  = *Parascutellinia arctespora* (Cooke & W. Phillips) T. Schum. (Synonymy based on type examination)
Vibrissea cf. *sporogyra* (Ingold) Sánchez （参照）旋孢水盘菌 (Zhuang *et al*. 2002)
Wenyingia sichuanensis Z. Wang & D.H. Pfister 文颖盘菌 (Wang & Pfister 2001)

CHANGES FOR NAMES IN THE PREVIOUS LISTS

Lambertella yunnanensis (Zhuang & Zhang 2002) for "*Helotium*" *yunnanense* (Tai 1979, Zhuang 1998a)
Lachnum mapirianum var. *mapririanum* (Yu & Zhuang 2002) for *Lachnum* cf. *apalum* var. *beatonii* (Zhuang 1998b, 2001)
Encoelia cubensis (this paper) for *Humaria xylariicola* (Tai 1979, Zhuang 1998a)
Hymenoscyphus fucatus (Zhang & Zhuang 2002) for *Hymenoscyphus scutulus* var. *fucatus* (Zhuang 1995, 1998a)
Hymenoscyphus menthae (Zhang & Zhuang 2002) for *Hymenoscyphus scutulus* var. *solani* (Korf & Zhuang 1985, Zhuang 1998a)

A NEW COMBINATION IN *LACHNUM*

Lachnum orinocense (Pat. & Gaillard) W.Y. Zhuang, **comb. nov.**
≡ *Erinella orinocensis* Pat. & Gaillard, Bull. Soc. Mycol. France 4: 101, 1889.
≡ *Dasyscyphus orinocensis* (Pat. & Gaillard) Dennis, Kew Bull. 9: 307, 1954.

Specimen examined: Venezuela. R. Orinoco, Puerto Zamuro, Maipures, on Canaceae, No. 34, 29 May 1887, FH - Herb. Patouillard S348 (type of *Erinella orinocensis*).

Notes: In connection with my study of discomycetes from tropical China, the type specimen of *Erinella orinocensis* from tropical America was examined. My observation indicates that it is a member of *Lachnum* Retz. A transfer to that genus is here proposed.

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TRICHOLOMA ZANGII, A NEW NAME FOR T. QUERCICOLA M. ZANG (BASIDIOMYCETES: TRICHOLOMATACEAE)

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ABSTRACT

Tricholoma zangii is proposed as *nomen novum* to replace *T. quercicola* M. Zang (1990), which is a later homonym of *T. quercicola* (Murr.) Murr. (1949). Zang's species grows under oak trees or shrubs and is probably a mycorrhizal fungus, whereas Murrill's was originally described from decayed wood at the diseased base of a living laurel oak. *Tricholoma zangii* is compared with *T. matsutake* and considered as a recognisable taxon, based on examination of the original collection of the former from China and of specimens of the latter from China and Japan. The distribution of *T. zangii* and its relationship with other species of the *T. matsutake* group are also discussed.

Keywords: nomenclature, *Tricholoma* sect. *Caligata*, *Tricholoma matsutake,* China

INTRODUCTION

The matsutake mushroom (*Tricholoma matsutake*-complex) is one of the most appreciated wild mushrooms, especially in Japan. The mushroom has been known and collected for more than 1000 years (Hosford et al. 1997, Bergius & Danell

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2000). Owing to a decline in Japanese production, importation of matsutake commenced in the 1970s from China, Korea, Canada, USA, Mexico and Morocco (Hosford et al. 1997, Wang et al. 1997). The amount of importation has reached 3,000 tons per year, about three-quarters of the total consumption in Japan (Wang et al. 1997). Exportation of matsutake mushroom from North America has increased one thousand-fold since the mid-1980s, reaching some 500 tons (Hosford et al. 1997). In Japan, the retail price of matsutake may be up to US$1275 per kilogram (Wang et al. 1997). The high value of matsutake has stimulated Swedish scientists to employ molecular methods to link the north European species *T. nauseosum* (Blytt) Kytöv with the Japanese matsutake (*T. matsutake* (S. Ito & S. Imai) Sing.) (Bergius & Danell 2000) and American scientists to produce a booklet to prompt good management of American matsutake (*Tricholoma magnivelare* (Peck) Redhead) in North America (Hosford et al. 1997).

During an investigation on Chinese species related to the matsutake mushroom, Zang (1990) published the name *T. quercicola* M. Zang for a fungus growing under *Quercus*. The fungus, considered a mycorrhizal fungus (Wang, B. 1995), is very similar to *T. matsutake*. It occurs in large quantities in southwestern China where it is sold in market places in addition to *T. matsutake*. However, *T. quercicola* M. Zang is a later homonym of *T. quercicola* (Murr.) Murr. (1949). Our investigation has shown that *T. quercicola* of Zang (1990) and Murrill (1949) are not conspecific and a new name is required for such an economically important fungus in China.

In his account on the species of *Tricholoma* (Fr.) Staude in Florida, U.S.A., Murrill (1949) published the name *Cortinellus quercicola* Murr. for a fungus growing on decayed wood at the diseased base of a living laurel oak (*Quercus laurifolia*) from Gainesville. Murrill indicated that in Saccardo's nomenclature the species would be placed under *Tricholoma* and also proposed the name *Tricholoma quercicola* (Murr.) Murr. as an alternative name. Thus he proposed two names simultaneously for only one fungus, but the names have to be counted as validly published because they were proposed before 1 Jan. 1953, according to the International Code of Botanical Nomenclature (ICBN, edition published in 2000) Art. 34.2.

In the present paper a new name is proposed for *T. quercicola* M. Zang and examination of the type material of the species confirms it to be a recognizable taxon within *Tricholoma* sect. *Caligata* Konr. & Maubl. ex Bon.

TAXONOMY

Tricholoma zangii Z. M. Cao, Y. J. Yao & Pegler, **nom. nov.**
≡*Tricholoma quercicola* M. Zang in *Act. Mycol. Sinica* 9: 123 (1990) non *Tricholoma quercicola* (Murr.) Murr. in *Lloydia* 12: 67 (1949).

Pileus 6 – 12 cm diam., convex to plano-convex; surface light brown to pale grey, sometimes darker at centre, dry, with light brown and appressed squamules; margin inrolled, entire, appendiculate. *Lamellae* sinuate-adnexed, adnexed to emarginate, crowded, whitish, 2.5 – 4.0 cm broad, with lamellulae of two lengths. *Stipe* 6 – 10 x 1.5 – 2.5 cm, robust, cylindrical, equal or slightly tapering towards the base; surface whitish and with small granules above the annulus, concolorous with pileus and scabrous below. *Annulus* apical, membranous. *Context* thick, whitish, comprising of thin-walled hyphae, 5.0 – 10.0 μm diam., lacking clamp-connexions. *Odour* strong, sweetish. *Taste* mild, pleasant. *Basidiospores* 6.5 – 10.0 x 5.0 – 6.5 μm, Q = 1.27, ellipsoid, hyaline, inamyloid, thin-walled, with a prominent hilar appendix. *Basidia* 16.0 – 26 x 7.0 – 12.0 μm, clavate, bearing four sterigmata. *Lamella-edge* heteromorphous, often with scattered cheilocystidia. *Cheilocystidia* 25 – 30 x 13.0 – 19.0 μm, clavate or ventricose-rostrate. *Hymenophoral trama* regular, hyaline, comprising parallel hyphae, 4.0 – 11.0 μm diam. *Pileipellis* a repent epicutis of tightly woven hyphae, 4.0 – 7.0 μm diam.

Specimens examined: China: Sichun, Miyi, 3000 m alt., under *Quercus pannosae*, 27 July 1984, Ming-sheng Yuan, HKAS 19947 (**holotype**); Sichun, Yajiang, 3400 m alt., under *Quercus aquilioidis*, 4 Aug. 1985, Wen-xian Li, HKAS 16977; Sichun, Xiangcheng, 3600 m alt., under *Quercus* spp., 17 July 1998, Z. -L Yang, HKAS 32450; Sichun, Xiangcheng, 3900 m alt., under *Quercus* spp., 17 July 1998, Z. -L Yang, HKAS 32449.

DISCUSSION

Tricholoma zangii is closely related to *T. matsutake.* The latter is found under species of *Pinus*, *Picea* and *Tsuga*, growing at 1500 – 2800 m altitude, whilst *T. zangii* occurs under *Quercus* at 3000 – 3900 m altitude. Macroscopically, *T. zangii* has a paler brown pileus and a weaker odour than *T. matsutake,* whereas, microscopically, the latter lacks cheilocystidia. However, the 'nearly multiangular spore form' mentioned for *T. zangii* by Zang (1990) cannot be confirmed, and does not offer a reliable distinction. Basidiomes of *T. zangii* are reported to contain significantly less methionine than those of *T. matsutake*, which could reflect differences in host (Zang 1990, Wang B. 1995, Wang M. -F. 1997). Throughout China, several related species occur but systematic study has remained inadequate to clarify the situation. The Section *Caligata* is abundant in the southwest and the northeast of China, especially in the Hengduan Mountains of the Tibetan Plateau (Tai 1979, Wang M. -F. 1997, Xian 1989). Collections of *T. matsutake* from the northeast are similar to those from Japan in both morphology and habitat, while in the southwest variations occur (Liao et al. 1989). Tominaga et al. (1988) proposed a new variety from Sichuan Province, under the name *T. matsutake* var. *qinggang* Y. Tominaga, but without a Latin diagnosis or description. When publishing his new species, however, Zang (1990) did not mention Tominaga and his colleagues' publication.

It is generally accepted that *T. zangii* grows in oak forests or mixed forests of oak and pine, with *Quercus aquifolioides* Rehd. & Wils., *Q. pannosa* Hand-Mazz., *Q. rehderiana* Hand-Mazz. and other *Quercus* species being the main hosts (Zang 1990, Wang B. 1995, Yuan & Shun 1995). It appears that *T. zangii* is restricted to the southwest of China, namely Sichun, Yunnan and South-eastern Tibet, but *T. matsutake* is distributed over the northeast and the southwest of China. *Tricholoma zangii* produces fruitbodies from late June to early September, whereas *T. matsutake* flushes from early August to late September.

Hitherto, clamp-connexions are not reported from the Section *Caligata*. In the holotype of *T. zangii* and in one specimen of *T. matsutake* (HMAS 61579) clamp-connexions have been observed at the base of the basidiome primordium. Commonly there is a thick and solid stipitipellis covering the base and on associated mycelial cords. The presence of clamp-connexions is known to be an unreliable character in a number of Tricholomataceae genera (Furtado 1966).

There are three species of the Section *Caligata*, namely *T. bakamatsutake* Hongo and *T. fulvocastaneum* Hongo from Japan, and *T. zangii* from China, which are confirmed to form ectomycorrhizal associations with species of *Quercus*. *Tricholoma bakamatsutake* occurs at 2000 – 2800 m alt., forming small basidiomes with a weak odour, whilst *T. fulvocastaneum* can be found at any altitude and lacks any characteristic odour (Qing & Li 1990). A project employing molecular methods is currently under way to elucidate the relationship between the *Tricholoma* species of oak forests and those of pine forests.

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NEW AND RARE RUST FUNGI (UREDINALES) FROM ANATOLIA (TURKEY)

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Abstract: Eleven rust species, one of which was identified only to sp., are reported from Anatolia in Asia Minor, Turkey. Four species are described as new, viz., *Puccinia malatyensis* on *Johrenia berytea, P. onosmatis* on *Onosma sericea, P. umbilicicola* on *Umbilicus erectus* and *P. yildizii* on *Echinophora tenuifolia. P. lactucarum* on *Scariola viminea* and *Uromyces eurotiae* on *Krascheninnikovia ceratoides* are reported as new members of the Turkish rust flora. *Petrorhagia alpina* represents a new host genus for *Uromyces dianthi* while *Clinopodium vulgare* ssp. *arundanum* does so for *Puccinia menthae* in Turkey.

Keywords: *Puccinia, Uromyces*, new species, Anatolia, Turkey.

Introduction

In Turkey the number of vascular plant species is estimated at 9000 of which 3000 are endemic (Davis 1965-1985, Davis et al. 1988, Güner et al. 2000). It is known that richness of host species is an important factor on microfungi diversity. Therefore, Turkey has a rich flora of microfungi. There have been some researches on Turkish microfungi (Karel 1958, Henderson 1964, Bahcecioglu 1998, 2001), but the knowledge of microfungal flora of Turkey is still at an early stage of development. The present study was carried out in the Sivas and Malatya provinces which are main centres of endemism in Turkey.

Materials and methods

The material were collected in the years of 1993-2001, prepared according to established herbarium practice and the spores were mounted in lactophenol The host names follow the Flora of Turkey and the Aegean Islands (Davis 1965-1985).

Enumeration

Puccinia caricina DC. s. lat. - Fl. Fr. 5: 60, 1815.
On *Carex hordeistichos* Vill. (Cyperaceae).
Malatya, Arapgir, 1000 m, 03-VII- 1993, Z. Bahcecioglu 177, II.

Uredinia amphigenous, brown. Urediniospores 27-37 x 21-27µm, mostly obovoid or ellipsoid, more rarely subgloboid, walls 1.5-2(-2.5)µm thick, pale brown with 2(-3) equatorial pores.This rust corresponds well to the description given by Zwetko (1993) of a rust on the same host in Austria. Henderson (1964) reported it on the same host from Sivas, Asia Minor, where also only uredinia were present. Moesz (1940) and Hinkova (1981) reported it on the same host from Hungary and Bulgaria, respectively (Moesz as *P. caricis* [Schum.] Rebent.).

Puccinia lactucarum H. & P. Syd. - Oesterr. Bot. Zeitschr. 51: 7, 1901.
On *Scariola viminea* (L.) F.W. Schmidt (syn. *Lactuca viminea* [L.] J. & C. Presl.). (Asteraceae).
Sivas, Zara, Tödürge lake, 1300 m, 14-VIII-1996, Z. Bahcecioglu 1191, III.

Telia on leaves, blackish brown. Teliospores 31-39 x 25-30µm, mostly ellipsoid or ovoid, usually rounded at the ends. Walls (2.5-) 3-4.5µm thick, brown, verrucose, upper pore apical or often subapical, lower pore equatorial or slightly more depressed. Pedicel hyaline, thin, to 70µm long, mostly broken just under the spore wall.

P. lactucarum seems to be a new rust species in Turkey. It has previously been reported on this host e.g. from Morocco (Guyot & Malencon 1957 on *L. viminea* var. *chondrilliflora* [Bor.] Car. & St.-Lager), and from Crete (Kapsanaki-Gotsi & Pantidou 1987 on *L. viminea*). The rust is widespread in Central and South Europe, in Asia scattered east to Mongolia. Its main host genus is *Lactuca.*

Puccinia malatyensis Gjærum & Bahcecioglu, *sp. nov.* (Fig. 1).

Etymology: Malatya, province in Turkey.

Pycnia, aecidia et uredinia ignota. Telia amphigena, pro parte maxime hypophylla, parva, brunnea. Teliosporae 35-52 x (23-) 26-34µm, ellipsoideae, obovoideae vel ovoideae, rare subgloboideae, pariete brunneo (2.5-) 4-4,5µm crasso, apicali usque ad 5.5 (-7.5)µm, laeve, poro superiore apicali, poro inferiore equatoriali vel interdum prope pedicellum, poris hyalinis papillas tectis. Pedicelli hyalini breves fragiles.

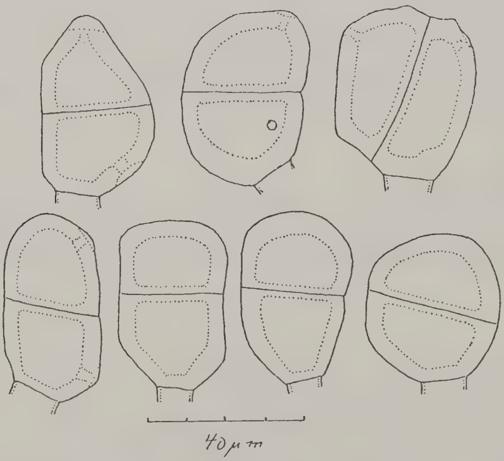

Fig. 1 *Puccinia malatyensis* Gjærum & Bahcecioglu, *sp. nov.*
Teliospores from type

Pycnia, aecia and uredinia not seen.Telia amphigenous, mostly hypophyllous, very small, blackish brown. Teliospores 35-52 x (23-) 26-34μm, very irregular, ellipsoid, obovoid - ovoid, rarely subgloboid, walls brown, uniformly thick, (2.5-)4-4.5μm, very irregular, apically thickened up to 5.5 (-7.5) μm or not thickened at all, smooth, upper pore more or less apical, lower pore equatorial or sometimes nearer the pedicel, covered by hyaline papillae. Pedicels hyaline, broken a few μm below the spore.
Holotype: Z. Bahcecioglu 215 (Inönü), Turkey, Asia, Malatya, 25 km from Malatya to Pütürge, 1400 m, 06-VII-1993, on *Johrenia berytea* Boiss. & Hausskn. (Apiaceae). Isotype in NCRI.

Dietel (1930) described two rust species, *Puccinia johreniae* on *J. fungosa* Boiss. and *P. johreniae-alpinae* on *J. alpina* Fenzl. Both were described with aecia which have not been seen in the new species. In both species described by Dietel the wall in the lower cells as gradually thinner towards the pedicels while in the new species it is uniformely thick.

Puccinia menthae Pers. - Syn. Meth. Fung. p. 227, 1801.
On *Clinopodium vulgare* L. ssp. *arundanum* (Boiss.) Nyman. (Lamiaceae).
Malatya, Venk village, Tavsan hill, 1500-1600 m, 06-VIII-1996, Z. Bahcecioglu 243, II.

Uredinia hypophyllous, yellowish brown. Urediniospores 20-27 x 17-20μm, subgloboid, ellipsoid or obovoid. Walls c 1μm thick, pale brown, echinulate with 2(-3?) obscure equatorial pores.In the specimen studied by us the urediniospore walls are slightly thinner than often given in the literature (1-2μm).

P. menthae has been reported several times from Turkey on *Mentha* spp., but also on species of *Calamintha, Micromeria* and *Origanum. Clinopodium* seems to be a new host genus for this rust in Turkey, but it has been reported from various countries in Europe, Asia and N. America, also on *C. vulgare.*

Puccinia onosmatis Gjærum & Bahcecioglu, *sp. nov.* (Fig. 2).

Etymology: from *Onosma*, a genus in Boraginaceae.

Pycnia epiphylla, typus 4. Aecidia aggregata, hypophylla. Peridia longa, alba, revoluta, cellulae peridialis 24-35 x 13-16μm, rhomboideae, pariete interiore 2.5-4μm crassa, verrucosa, pariete exteriore 2.5-3.5μm, striata. Aecidiosporae 24-28 x 20-23μm, ellipsoideae vel subgloboideae, pariete 1(-1.5)μm crassa, hyalina, dense verruculosa. Uredinia ignota. Telia amphigena, pustulata, nigra, epidermide tecta, cum brunneis paraphysibus. Teliosporae 39-49 x 19-26 (-29)μm, ellipsoideae vel clavatae, ad septum saepe constrictae, pariete laterale 1(-1.5)μm, brunneolo, apice usque ad 4μm, laeve, poro superiore apicali vel subapicali, poro inferiore prope septum, obscuro, pedicello brevi, hyalino. Pycnia epiphyllous, type 4. Aecia in groups, hypophyllous. Peridia long, white, revolute. Peridial cells 24-35 x 13-16μm, rhomboid, inner walls 2.5-4μm thick, verrucose, outer walls 2.5-3.5μm, striate. Aeciospores 24-28 x 20-23μm, ellipsoid or subgloboid, walls 1(-1.5)μm thick, hyaline, densely verruculose. Uredinia not seen.

Telia amphigenous, pustulate, black, long covered by epidermis, loculate with brown paraphyses.Teliospores 39-49 x (17-)19-26 (-29)μm, ellipsoid or clavate, often constricted at septum, sidewalls 1(-1.5)μm, pale brown, apically thickened to 4μm, reddish brown, smooth, upper pore apical or subapical, lower near septum, obscure. Pedicels short, hyaline.

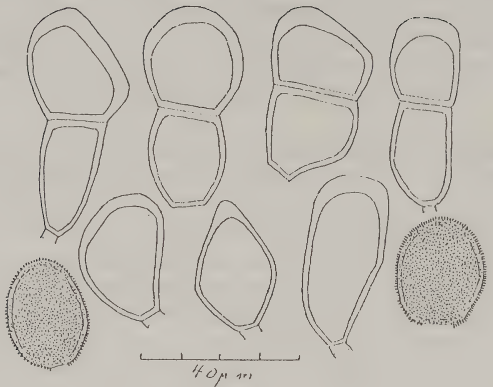

Fig. 2 *Puccinia onosmatis* Gjærum & Bahcecioglu, *sp. nov.*
Telio- and aeciopores from type

Holotype: Z. Bahcecioglu 106 (Inönü), Turkey, Malatya, Darende, 1000 m, 25-VI-1993, on *Onosma sericea* Willd. (Boraginaceae). Isotype in NCRI.

To our knowledge no *Puccinia* has been described on *Onosma.* Previously *Aecidium asperifolii* Pers. (syn. *A. onosmatis* Thüm.) has been reported on several species of *Onosma.* Pantidou & Henderson (1977) who reported the aecidial stage on *Onosma* sp. from Greece, indicated it might belong to *P. recondita* Rob. ex Desm. s. lat.

Puccinia poarum Niels. - Bot. Tidsskr. 3, 2: 34, 1877.
On *Tussilago farfara* L. (Asteraceae).
Sivas, 10 km N of Sivas, 1500 m, 04-VI-1997, Z. Bahcecioglu 1550, 0+I.

Pycnia epiphyllous. Aecia hypophyllous in groups. Peridia long, white, revolute. Aeciospores 20-24 x 16-21μm, mostly subgloboid, often somewhat angular, walls 1μm thick, densely verrucose with refractive bodies.The aecia were heavily attacked by a *Cladosporium* sp.

P. poarum, host alternating especially with species of *Poa,* is widespread in Europe and Asia, and occurs also in Africa and the Americas. Bremer et al. (1952) reported aecia on the present host while Henderson (1964) reported uredinia and telia on *P. pratensis* L. He also mentioned a find of aecia on *Petasites hybridus* (L.) Gaertner, Meyer & Scherb. which might belong to *P. poarum.*

P. petasiti-poarum Gäumann & Eichhorn described in as alternating between species of *Petasites* and *Poa,* developed «unter günstigen Bedingungen» pycnia on *T. farfara* (Gäumann 1941). Cummins (1971) and Majewski (1979) listed this species as a synonym of *P. poarum.* After having compared aeciospores from the type of *P. petasiti-poarum* (Herb. Z) with aeciospores from Norwegian specimens of *T. farfara*, the two aecidial stages might be difficult to separate morphologically.

Puccinia umbilicicola Gjærum & Bahcecioglu, *sp. nov.* (Fig. 3).

Etymology: from *Umbilicus*, a genus in Crassulaceae.

Pycnia, aecidia et uredinia ignota. Telia amphigena, parva, dense fasciculata, circa 1 cm lata, vel confluentia, epidermide tecta, nigra. Teliosporae 44-74 x 20-29μm, ellipsoideae, obovoideae, clavatae, saepe irregulares, apices rotundatae, truncatae vel attenuatae, paries laevis, cellula inferiore 1-1.5μm crassa, cellula superiore 3-4μm, ad apicem usque 9 (-13)μm, spadiceus, apicali brunneo, poro superiore apicali, poro inferiore prope septum, obscuro. Pedicelli usque ad 21μm longi, saepe fracti. Sporae unicellulares 41-55 (-70) x 23-30μm, irregulares.

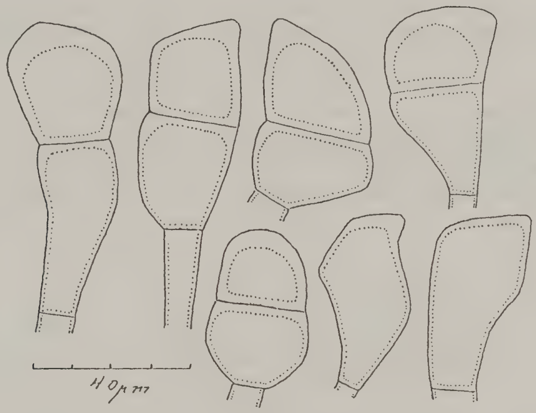

Fig.3 *Puccinia umbilicicola* Gjærum & Bahcecioglu, *sp. nov.*
Teliospores from type

Pycnia, aecia and uredinia not seen. Telia amphigenous, small, in dense clusters about 1 cm wide or confluent, long covered by epidermis, black. Teliospores 44-74 x 20-29μm, ellipsoid, obovoid, clavate, often irregular, apically rounded, truncate or oblique attenuate, walls smooth, in lower cells 1-1.5μm thick, in upper cells 3-4μm, apically thickened to 9 (-13)μm, pale brown, apically brown, upper pore apical, lower pore near septum, very obscure. Pedicels up to 21μm long, often broken shorter. One-celled spores 41-55(-70) x 23-30μm, irregular.
Holotype: Z. Bahcecioglu 235 (Inönü), Turkey, Asia Minor, Malatya, Venk village, Tavsan Hill, 1500-1600 m, 06-VIII-1996, on *Umbilicus erectus* DC. (Crassulaceae). Isotype in NCRI.

The species differs from *P. umbilici* Guepin especially in the form and size of the teliospores which in *P. umbilici* are regularly ellipsoid and smaller (e.g. in Wilson & Henderson 1966 20-35 x 17-26μm) with walls uniformly thick, 1.5-2μm, rarely with a few verrucae.

Puccinia sp.
On *Scorzonera* sp. (Asteraceae).
Sivas, Bingöl tuzlas, 1300 m, 04-VI-1997, Z. Bahcecioglu 1587, 0+I.

Pycnia epiphyllous, type 4. Aecia hypophyllous covering the whole leaf, pustulate, peridia white. Aeciospores 25-38 x 20-30μm, ellipsoid, subgloboid or angular, walls 1μm thick, densely verruculose, pores obscure.

Two rust species are in question, viz. *P. jackyana* Gäum. and *P. podospermi* DC. As nothing is known about the host identity the identification of the rust species will be uncertain. It should however be mentioned that Henderson (1964) reported *P. podospermi* from Asia Minor.

Puccinia yildizii Gjærum & Bahcecioglu, *sp. nov.* (Fig. 4).

Etymology: in honour of Dr. B. Yildiz, teacher of the first author of this publication.

Pycnia et aecia ignota. Uredinia et telia in caule et amphigena, rotundata, saepe confluentia formantes sori longi pulverulentes. Uredinia brunnea, telia atrofusca, saepe inter uredinia dispersa. Urediniosporae (22-) 27-30 (-33) x 18-23μm, ellipsoideae vel obovoideae, parietes pallide luteoli, 1.5-2 (-2.4)μm crassi, echinulati, cum 2-3 equatorialibus poris. Teliosporae 32-37 (41) x 23-26μm, ellipsoideae sparsim vel obovoideae ad septum leviter constrictae, paries 2-2.5μm crassus, cinnamomeus, ad apicem usque 3-3.5μm, verruculosus, poro superiore apicali, poro inferiore prope pedicellum, pedicelli usque ad 40μm longi, pro parte maxime decidui.

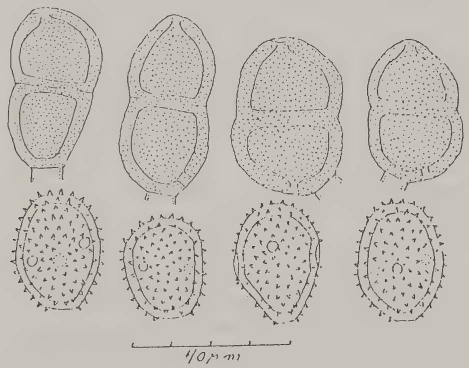

Fig. 4 *Puccinia yildizii* Gjærum & Bahcecioglu, *sp. nov.*
Teliospores from type

Pycnia and aecia not seen. Uredinia and telia on stems and amphigenous on leaves, roundish, often confluent forming long sori, pulverulent, uredinia brown, telia dark brown, often mixed with uredinia. Urediniospores (22-) 27-30 (-33) x 18-23μm, ellipsoid or obovoid, walls pale yellowish, 1.5-2 (-2.5)μm thick, distantly echinulate with 2-3 equatorial pores, covered with low, hyaline papillae. Teliospores 32-37 (-41) x 23-26μm, ellipsoid or obovoid, slightly constricted at septum, walls 2-2.5μm thick, cinnamon brown, apically thickened to 3-3.5 μm, verruculose. Upper pore apical, lower pore near the pedicel. Pedicels up to 40μm long, mostly deciduous or broken just below the spore.

Holotype: Z. Bahcecioglu 209 (Inönü), Turkey, Malatya, Arapgir, Eynir village, 1100 m, 03-VII-1993, on *Echinophora tenuifolia* L. (Apiaceae). Isotype in NCRI.

P. yildizii differs from *P. echinophorae* Brandenburger & M. Steiner on *E. scabra* Gilli having shorter uredinio- and teliospores. Urediniospore walls are uniformly thick while in *E. echinophorae* they are apically thickened to 3-4.5µm. Teliospores of *P. yildizii* are verrucose while smooth in the other.

P. echinophorae has been reported by Durrieu (1975) on *E. scabra* from Afghanistan.

Uromyces dianthi Niessl.- Verh. Naturf. Ver. Brünn 10: 162, 1872.

Syn. *U. caryophyllinus* Wint. - Rabh. Krypt.-Fl. Ed. 2,I: 149,1882.

On *Bufonia virgata* Boiss. (Caryophyllaceae).

Malatya, Akcadag, Levent, 1300 m, 26-IX-1992, B.Yildiz 9958, III.

On *Petrorhagia alpina* (Habl.) P.W. Ball & Heywood (syn. *Gypsophila alpina* Habl.). (Caryophyllaceae).

Malatya, Venk village, 1100 m, 08-VI-1995, B.Yildiz, 12550, III.

Telia on stems, sori up to 19 mm long, more or less covered by the cracked epidermis. Teliospores of *B. virgata* (21-) 24-27 (-30) x 20-24µm, walls 2-2.5 (-3.5), of *P. alpina* (25-) 29-31 x (22-) 25-31µm, walls (1.5-) 2-2.5 (-3)µm thick, for both hosts the spores are subgloboid, ellipsoid or obovoid, brown, young spores yellowish, densely and finely verrucose with a low hyaline papilla over the pore. Pedicel hyaline, often broken.

U. dianthi is a widespread rust species occurring on many caryophyllaceous genera, but on *Bufonia* it sems to be fairly rare. On *B. virgata* it has previously been reported by Maire (1906 as *U. caryophyllinus* [Schr.] G. Wint.) from Cappadocia. H. & P. Sydow (1908) and Bornmüller (1911) recorded the rust on *B. macrocarpa* Ser. from Iran while Guyot (1967 as *U. caryophyllinus)*) reported it on *B. tenuifolia* L. from Spain.

Petrorhagia seems to be a new host genus for the rust. In Turkey it has been reported by Bahcecioglu & Isiloglu (1996) and by Bahcecioglu & Yildiz (1996) on *Gypsophila pilosa* Hudson and *Dianthus floribundus* Boiss., respectively.

Uromyces eurotiae Tranzschel. – Ann. Mycol. 5: 547, 1907.

On *Krascheninnikovia ceratoides* (L.) Güldenst. (syn. *Eurotia ceratoides* (L.) C.A. Meyer). (Chenopodiaceae).

Sivas, between Kangal and Gürün, 1400 m, 10-VI-1996, B. Yildiz 13815, II.

Uredinia amphigenous, mostly hypophyllous, brown. Urediniospores 22-29 x 18-22m, ellipsoid or obovoid, rarely subgloboid, walls (1-)1.5-2µm, yellowish brown, echinulate with mostly 3 (2-4) pores, approximately equatorial.

This rust was described only with telia. It has been reported from Ukraina to Kirgizia, the host given as *E. ceratoides*, the only known, so far. *U. eurotiae* is a new member of the rust flora of Turkey.

Vasjagina (1966) might be the first one who mentioned uredinia, but without description. Description of the spores was given e.g. by Kuprevich & Ul'janischev (1975).

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TAXONOMIC AND NOMENCLATURAL CLARIFICATION OF THE ONION NECK ROTTING BOTRYTIS SPECIES

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Abstract: Five species of *Botrytis* are recognized as being associated with neck rot of onions: three of them, *B. aclada, B. byssoidea* and *B. allii,* exclusively. Due to the difficulty of distinguishing them by morphological criteria and lack of type material associated with *B. aclada* and *B. allii*, several synonomies have been proposed. We suggest that *B. aclada* and *B. allii* are both valid names. Species may be differentiated by conidial size, but the character is subtle, variable and there is some overlap. Both the smallest spored group (*B. aclada*) and the largest spored group (*B. byssoidea*) have 16 mitotic chromosomes, while the intermediate group (*B. allii*) has 32. Based on significant differences in Nei's coefficient of genetic differentiation derived from universally primed PCR (UP-PCR) fingerprints it was possible to recognize distinctions among the three exclusively neck rot-associated *Botrytis* spp. and *B. cinerea* and *B. squamosa*. Primers, designed from a sequence characterized UP-PCR fragment were used for direct sequencing of DNA from isolates of the 16 chromosome nomengroups. Because of apparent ambiguities in the UP-PCR fragment from the 32-chromosome group, it was cloned and re-sequenced. Sequence alignment and unrooted clustering show identity with the small-spored *B. aclada* and the large-spored *B. byssoidea* for the two cloned DNA fragments from the intermediate, *B. allii*. Further, the internally transcribed spacer rDNA (ITS) amplicons of *B. aclada* have 2 *Sph*I restriction sites; those of *B. allii* and *B. byssoidea* have 1 *Sph*I site. The cumulative data suggest that the three groups are genetically distinct and that isolates of *B. aclada* and *B. byssoidea* were the ancestors of the polyploid *B. allii.*

Keywords: *Botryotinia,* universally primed polymerase chain reaction

Seven named species of the form genus *Botrytis* have been associated with diseases of *Allium* (Hennebert 1973). Of these, five have been associated with the onion neck rot disease. *B. aclada* Fresenius was described and validly published in 1850, *B. allii* Munn

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was described as a species in 1917 and was called the causal agent of sclerotial neck rot by Walker (1925) who also described *B. byssoidea* Walker, the anamorph of *Botryotinia allii* (Sawada)Yamamoto as causal agent of mycelial neck rot. In his 1963 work on the *Allium*-associated *Botrytis* species, Hennebert synonomized *B. allii* and *B. aclada*, applying the name *B. allii*, presumably because there is no known material associated with Fresenius's description. In 1973, he reversed himself and assigned the earlier *B. aclada* to the synonomy. Type specimens do not exist for either *B. aclada* or *B. allii*, although a mixed collection of Munn's authentic material is on deposit at the CUP Herbarium, Cornell University, Ithaca, NY. *B. squamosa* Walker, better known as the cause of onion leaf blight, is also the causal agent of small sclerotial neck rot (Owen *et al.* 1950), while *B. cinerea* Pers. Fr. is occassionally isolated from decayed onion necks.

Lacy and Lorbeer (1995) suggested that *B. byssoidea* is conspecific with *B. aclada*. In the context of developing a molecular method for detection and differentiation of onion-associated *Botrytis* spp., it was shown that the species *B. byssoidea* and *B. aclada* were different species (Nielsen *et al.* 2001). In the same work, it was further demonstrated that there are two genetically distinct populations within the *B. aclada* group. The two groups can also be distinguished by haploid chromosome number (Shirane *et al.* 1989) and, less clearly, by conidial dimensions (Hennebert 1963, Shirane *et al.* 1989, Nielsen and Yohalem 2001). Nielsen and Yohalem (2001) determined the sequences for a universally primed amplification product and showed that ambiguities in the sequence for the larger-spored sub-group of *B. aclada* can be explained by invoking a hybridization event between an isolate from the small-spored group and one from *B. byssoidea*.

In order to further clarify the taxonomic relationships between the two groups of *B. aclada* and *B. byssoidea* we cloned and sequenced the PCR products of the putative hybrids and microscopically examined some of the materials on deposit at the Mycothèque de L'Université catholique de Louvain (MUCL) Herbarium (Belgium) and the Cornell University Plant Pathology (CUP) Herbarium (USA). We also attempted to amplify DNA from the CUP material. Presented here are results of the above investigations and emendations of the descriptions of *B. aclada* and *B. allii.*

Materials and methods:

Specimens, measurements, pathogenicity and statistical analyses.

Fungal specimens used in this study and their spore measurements are given in Table 1. One hundred conidia from each specimen were examined and measured at 500 X under Nomarski illumination on a Nikon microscope. Spore measurements were converted to spore volumes (estimated as $0.5 \text{ length} \times 0.5 \text{ width} \times 0.5 \text{ width} \times 4\pi/3 = \text{width}^2 \times \text{length} \times \pi/6$) and to length:width ratios. Oneway analyses of variance were performed using the general linear models subroutines in the SAS/STAT program package and multivariate analyses of variance were performed using MANOVA subroutines (SAS version 8.2, SAS Institute, Inc., Cary, NC). Also examined, but excluded from the table due to paucity of material were CUP-045958 and CUP-047952 from over-wintered onion refuse (East Lansing, MI); both were collected by Munn. The specimens of *B. aclada sensu lato*, numbers MUCL8, 17, 18, 99, 109, 335, 403*, 487, 488, 489, 494, 568, 602, 1105, 1151, 1161, 1920, 3109*, 3528, 3537, 3577, 3578, 3810, 4386, 4387, 4388, 4389, 4390,4391, 4392, 4393, 4394, 4396, 4397 4398, 4400 4401,4402 4403, 4404, 4405, 4406, 4407, 4408, 4409, 4410, 4411, 4412, 4413, 4414, 5938, 6614, 7781, 9114, 9385, 10184, 10186, 18967, 20329, 22451 and 22466 from the MUCL herbarium (Belgian Cooredinated Collection of Microorganisms, Louvain-la-Neuve, Belgium) were examined, but were quite dessicated and resisted rehydration and hence, were exluded from the study. Asterisks after the isolate number mean that living cultures of the indicated isolates were also examined.

Table 1. Fungal isolates, their origin, substrate of isolation, conidial dimensions, chromosome number and several genetic characters for isolates used in this study.

Isolate no.	Original no.	Origin	Isolated from	Conidial dimensions (µm) [a]	UP-PCR group[b]	ITS# *SphI*[c]	*#ApoI*[d]
B. aclada							
BA2	BA2[e]	Denmark	Bulb of *A. cepa*	9.0(1.4)×54.8(0.6)	AI	3	A
SAL003	IFO9430[f]	Japan	*A. cepa*	8.6(0.8)×4.7(0.6)	AI	3	A
SAL005	HN001[f]	Japan	*A. cepa*	8.3(0.8)×4.5(0.5)	AI	3	A
SAL006[g]	KF297[f]	Japan	*A. cepa*	8.6(0.9)×4.6(0.5)	AI	3	A
BA8	MUCL 3037[h]	Canada	Bulb of *A. cepa*	9.1(1.2)×4.8(0.5)	AI	3	A
BA9	MUCL 3106[h]	USA	Bulb of *A. cepa*	9.2(1.1)×5.2(0.5)	AI	3	A
BA13	MUCL 8415[h]	Germany	Bulb of *A. cepa*	*ns*	AI	3	A
BA19	B4090[h]	UK	Bulb of *A. cepa*	10.4(1.5)×5.6(0.7)	AI	3	A
B. allii							
SAL001	SAL001[f]	Japan	*A. cepa*	10.8(1.5)×6.3(0.5)	AII	2	A+B
SAL002[g]	SAL002[f]	Japan	*A. cepa*	10.2(1.0)×5.7(0.4)	AII	2	A+B
SAL004	HN001[f]	Japan	*A. cepa*	10.7(1.6)×6.0(0.5)	AII	2	A+B
BA4	MUCL 403[h]	Holland	Bulb of *A. cepa*	9.9(1.3)×5.3(0.6)	AII	2	A+B
BA6	MUCL 961[h]	Belgium	Bulb of *A. cepa*	10.3(1.2)×5.9(0.4)	AII	2	A+B
BA7	MUCL 1150[h]	Norway	Bulb of *A. cepa*	10.1(1.5)×5.7(0.5)	AII	2	A+B
BA10	MUCL 3109[h]	Japan	Leaf of *A. cepa*	10.6(1.3)×5.8(0.5)	AII	2	A+B
BA11	MUCL 3614[h]	Egypt	Bulb of *A. cepa*	14.1(1.8)×6.3(0.7)	AII	2	A+B
BA16	MUCL 18868[h]	Scotland	Bulb of *A. cepa*	13.0(1.5)×5.9(0.6)	AII	2	A+B
B. byssoidea							
BB1[g]	MUCL 94[h]	USA	Bulb of *A. cepa*	*ns*	B	2	B
BB5	MUCL 9113[h]	Holland	*A.cepa*	*ns*	B	2	B
BB6	B3730[i]	UK	*A. porrum*	11.8(1.2)×7.0(0.5)	B	2	B

[a] Average length × width of 100 conidia. Numbers in parentheses are standard errors of the means.; ns = nonsporulating in culture. [b] Groups of *Botrytis* isolates based on UP-PCR profiles, AI=*B. aclada* and AII=*B. allii* (see Nielsen *et al.* 2001). [c] Number of fragments after *Sph*I digestion of ITS1-ITS4 amplification product. [d] Restriction pattern of L45-550 SCAR PCR fragment digested with *Apo*I, A: *B .aclada* AI type, B: *B. byssoidea* type (B), A+B: *B. allii* type (mix of AI and B) (see Nielsen and Yohalem, 2001). [e] Danish Institute of Agricultural Sciences (DIAS), Research Center Flakkebjerg, 4200 Slagelse, Denmark. [f] Dr. M. Masuko, Aburahi Laboratories, Shionogi Research Laboratories, Shionogi & Co., Ltd., Kako-cho, Shiga 520-34, Japan. [g] Type, neotype or epitype specimen. [h] Belgium Coordinated Collection of Microorganisms (BCCM), Université catholique de Louvain, B-1348 Louvain-la-Neuve, Belgium. [i] Dr. Sian R. Kenny, HRI, Wellesbourne, Warwick CV359EF, UK.

Virulence of 5 randomly selected isolates of *B.aclada sensu lato* was assessed and compared to a water control. Onion (cv. *Centurion*) bulb necks were cut aseptically and inoculated by placing two mycelial discs (9 mm diameter from 14-d PDA cultures cultivated at 21°C under near-UV light) onto the fresh 2-3 cm diameter infection court. Depth of maceration was estimated after incubation in dark moist chambers at 18 °C for 14 d.

Sequence analysis of fungal isolates

Sequence characterized DNA fragments of the large-spored sub-group's DNA were cloned and sequenced. Sequence data were aligned with those previously established for *B. byssoidea* and for the small-spored sub-group (Nielsen and Yohalem 2001). DNA extraction from the fungal isolates SAL001, SAL002 and SAL004 and PCR amplification using the primers BA2f and BA3r was performed according to Nielsen *et al.* (2002). DNA extraction and amplication was also attempted for the 85 year-old CUP material. One µl of the PCR reaction was used in a cloning reaction using the pCR2.1-TOPO vector from the TOPO™ TA cloning® kit (Invitrogen BV, Groningen, The Netherlands) according to the manufacturer's instructions. Clones were screened for restriction type using the restriction enzyme *Apo*I according to Nielsen *et al.* (2002). Two clones of each restriction type were selected for sequencing in both directions using the Big-Dye™ Terminator Cycle Sequence Ready Reaction (Applied Biosystems, Warrington, UK) and sequence specific primers. The sequence amplification products were analyzed on an ABI Prism™ 310 Genetic Analyzer (PE Applied Biosystems, Foster City, Calif., USA.). Sequences were aligned using a word processor.

Phylogenetic analysis of UP-PCR *L45-550* sequences (Nielsen and Yohalem 2001) was performed using a neighbor-joining distance analysis in PHYLIP (Felsenstein 1993). Support for branches was assessed by using one thousand bootstrap replicates of the dataset (Felsenstein 1985), and the analysis was performed with the SEQBOOT, DNADIST, NEIGHBOR and CONSENSE programs in PHYLIP. Phylograms were visualized using the program TREEVIEW (Page 1996).

Results and discussion

Four clones were sequenced and their sequences compared to the previously determined sequences of *B. aclada* A1 (*sensu* Nielsen and Yohalem 2001) and *B. byssoidea* (Fig. 1). The two cloned sequences each, from SAL002 and SAL004, were identical to the sequences used to characterize *B. aclada* SAL003, *B. aclada* SAL006 and *B. byssoidea* BB1 over the 401 bp region.

Statistically significant differences were observed between the groups of *B. aclada sensu* Hennebert for spore length, width and volume ($P<0.0001$, 0.001, and 0.0001, respectively) however there is observed overlap between the groups (Table 1, Fig. 2). No statistically significant difference was found between length to width ratios of the two groups.

No difference was observed in pathogenicity to onion among isolates from the two groups of *B. aclada* Hennebert (0.76 ± 0.24 [where the second number is the standard error] and 0.68 ± 0.22 mm, for *B. aclada sensu* Fresenius and *B. allii*, respectively) however neither *B. cinerea* (0.41 ± 0.22 mm) nor *B. squamosa* (0.25 ± 0.15 mm) caused as much tissue maceration as they.

It is clear that *B. byssoidea* and *B. aclada sensu* Hennebert are distinct species (Nielsen *et al.* 2001). They can be distinguished morphopogically, although in diagnosis, this distinction relies more on the absence of sporulation in culture for isolates of *B. byssoidea* than on clearly distinct features of characters that are present. Moreover, conidia of *B. aclada sensu* Hennebert have fewer nuclei than do those of B. byssoidea (Shirane et al. 1989).The groups can also be separated by UP-PCR group, and by L45-550 sequence data. However, it is clear that we are dealing with three separate species: *B. byssoidea*, *B. aclada sensu* Fresenius and *B. allii* (Nielsen et al., 2001, Nielsen and Yohalem, 2001). Additionally, sequence data support the separation of the two groups. The paucity of differences in rDNA ITS sequences between *B. aclada sensu* Hennebert and *B. byssoidea* (Nielsen, *et al.* 1999) is not inconsistent with reports of lack of variation among species of *Fusarium* (Lieckfeldt & Seifert 2000) or *Armillaria* (Schulze et al. 1997) and serves to show the close relationships between members of the form genus.

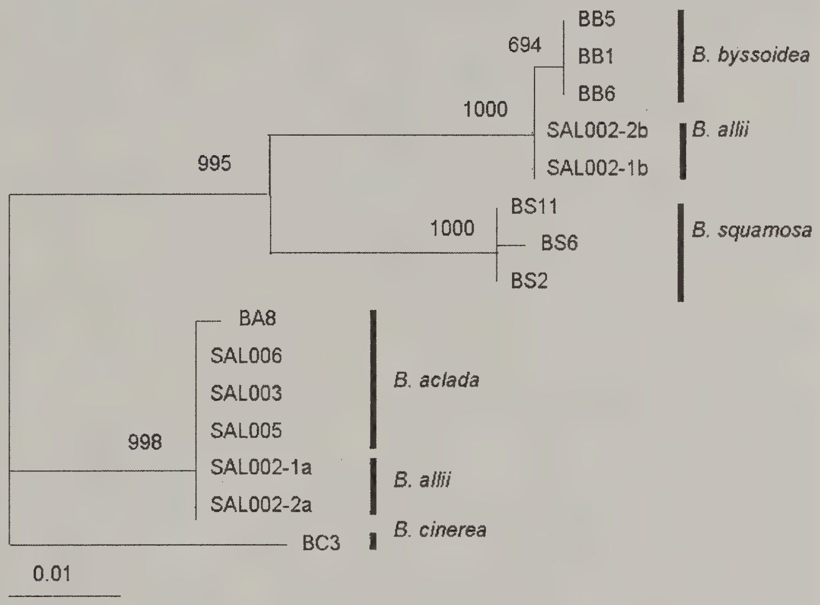

Figure 1. Neighbor joining tree of the sequenced UP-PCR DNA fragment *L45-550.* Only data for SAL002 of the *B. allii* isolates are presented. Isolates were direct sequenced except for SAL002, which was cloned and sequenced. Number at major branches indicates number of occurences of the cluster to right of the branch among 1000 bootstrap trees generated Bar represents genetic distance.

Distinctions can be made between *B. aclada sensu* Fresenius and *B. allii sensu* Munn (called group II in Nielsen and Yohalem 2001). *B. aclada* has statistically significantly, although subtly, smaller conidia than *B. allii (*Nielsen and Yohalem 2001, Shirane *et al.* 1989). The two species group independently by UP-PCR analysis. Sequence data show that the two different cloned fragments from *B. allii* are identical with those of *B. aclada* and *B. byssoidea* (Fig.1), which supports the hypothesis of interspecific hybridization as opposed to autodiploidy, as suggested by Shirane *et al.* (1989). Shirane *et al.* (1989) also report the presence of 'threadlike structures' in association with chromosomes of all *Botrytis* species examined. In contrast with expectation and unexplained, is the presence of only one threadlike structure in nuclei of *B. allii.* However, they suggest that a second 'threadlike structure' may have been present and unobserved due to interference with chromosomal material. *B. aclada* ITS sequences are digested at two loci, *B. byssoidea* ITS rDNA is digested at one site, and there is a single site within the ITS sequence of *B. allii* digested by*Sph*I, which is also in conflict with expectation. This may, however, be resolved by invoking concerted

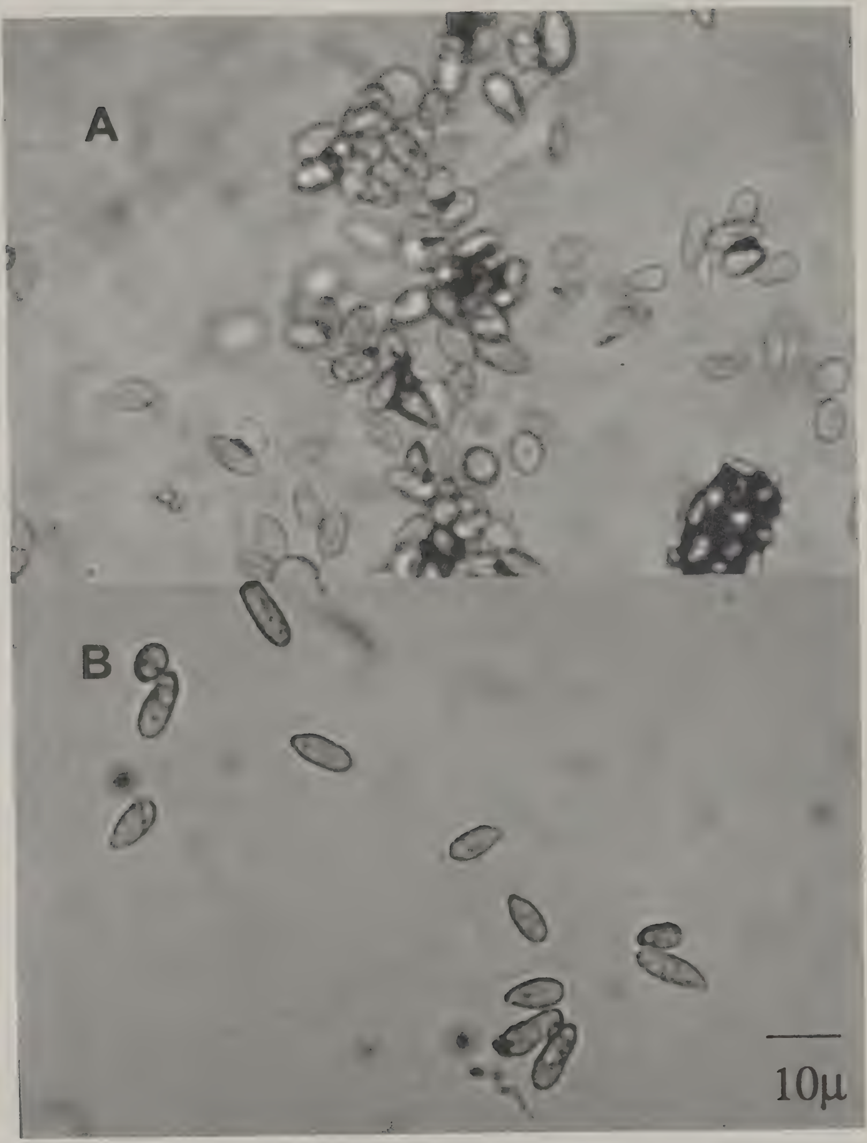

Figure 2. Conidia of: **A**. *B. aclada*, isolate SAL006 (CUP 65773, Cornell University, Ithaca NY), the neotype; and **B**. *B. allii* isolate SAL002 (CUP 65774), the epitype, mounted in water and observed at 500X magnification under Nomarski optics.

evolution or, alternatively, the possibility of a different parental clone. We suggest that the scenario of *B. aclada* and *B. byssoidea* hybridizing through hyphal anastomosis and subsequent karyogamy during coinfection of an *Allium* as the plausible origin of *B. allii.*

Although no specimen has been found in association with Fresenius' description of *B. aclada*, the inclusion of drawings with his description serves to validly typify the name (Fresenius 1850). In synonymizing *B. aclada* with the later *B. allii*, Hennebert (1963) suggested that Fresenius's material may have been immature (noting that this would explain the apparent difficulty of spore detachment from the substrate that Fresenius mentions and draws, as well as accounting for the disparity in spore dimensions) and that Munn may have ignored the possibility when he described *B. allii*. However, Hennebert also observed two classes of isolates: a large-spored and a small-spored group. This observation is supported by those of Shirane *et al.* (1989) and Nielsen and Yohalem (2001). The morphological distinction, although subtle, supports the recognition of the two groups as distinct species.

Therefore, we propose that the name *B. aclada* Fresenius be reserved for the small-spored sub-group of sclerotial neck rot inducing *Botrytis* and that *B. allii* Munn be exclusivley applied to the larger-spored subgroup and that the names be epitypified with the specimens described below, which have been described morphologically, cytologically and genetically.

Botrytis aclada Fresenius 1850 Beiträge zur Mykologie. Frankfurt am Main. p. 16-17. Taffel II Figs. 23-24.--- Abundant production of dense hyaline or light gray-brown ovoid-oblong conidia, 6.5-**8.6**-11.0 × 4.0-**4.6**-6.0 μm, from terminal ampullae on short, dark dichotomously branching conidiophores. Dark gray-brown in potato dextrose agar culture. Few, if any sclerotia in culture, but relatively abundant on artificially inoculated onion necks. Sixteen mitotic chromosomes. UP-PCR group AI, 3 rDNA internal transcribed sequence *Sph*I restriction fragments. L45 sequence group A. GenBank accession number AJ291480. Habit: in decaying onion necks. Teleomorph unknown. Epitype CUP 65773. An iso-epitype has been deposited with the MUCL (MUCL#44702) and living cultures are deposited with the American Type Culture Collection, Manassas, VA, USA and with the MUCL.

Botrytis allii Munn 1917 New York (Geneva) Agr. Exp. Sta. Bul. 437:396-97. Plates I-III, Figs.1, 3 ,4 ,5, 7, 8, 9, 10, 23, & 24, Plate VII, Plate XI, Fig. 1 --- Abundant production of dense hyaline or light gray-brown ovoid-oblong conidia, 9-**10.2**-15.0 × 5-**5.7**-6.5 μm, from terminal ampullae on short, dark dichotomously branching conidiophores. Dark gray-brown in potato dextrose agar culture. Few, if any sclerotia in culture, but more or less abundant on artificially inoculated onion necks. Thirty-two mitotic chromosomes, UP-PCR group AII, 2 rDNA internal transcribed sequence *Sph*I restriction fragments. L45 sequence groups A and B. GenBank accession numbers AJ291480 & AJ291481.Teleomorph unknown. Hab. in decaying onion necks. Epitype CUP 65774. An iso-epitype has been deposited with the MUCL (MUCL#44071) and living cultures are deposited with the American Type Culture Collection, Manassas, VA, USA and with the MUCL.

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VOLVOLEPIOTA AND MACROLEPIOTA – MACROLEPIOTA VELOSA, A NEW SPECIES FROM CHINA

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A new volvate *Macrolepiota* species from China, *M. velosa*, is described, and *Volvolepiota* is synonymized with *Macrolepiota*. Two new names in *Macrolepiota* are proposed, viz. *M. pulchella* for *V. brunnea*, and *M. brunnescens* for *V. albida*.

Keywords: distribution, taxonomy, systematics

While studying the agarics in the province of Yunnan, in southwestern China, the second author collected a peculiar species of the genus *Macrolepiota* Singer. The slender basidiocarps are provided with a volva, and veil remnants are present as whitish patches on the pileus on top of the dark brown squamules.

These characters, especially the presence of a volva, were used by Rick (1938) to distinguish the genus *Lepiotella*. Unfortunately, *Lepiotella* Rick is a homonym of *Lepiotella* (E.J. Gilbert) Konrad described in 1934. Singer (1953) examined Rick's specimens of *L. brunnea*, the type species, and at that time called these 'merely a volvate *Macrolepiota* (*Lepiotas* of the *procera*-type).' Later, Singer (1959) proposed the new name *Volvolepiota* for *Lepiotella* Rick. Heinemann & de Meijer (1996) also concluded that '*Volvolepiota* may not be fundamentally different from *Macrolepiota* by virtue of the volva, which is only more conspicuous in the former genus', but nevertheless retained *Volvolepiota* as a separate genus.

Molecular investigations of the ITS-regions have shown that species with a volvate base and velar remnants on the pileus do indeed form a separate clade, but this clade is situated either within *Macrolepiota* in the strict sense or at the base of the *Macrolepiota* clade (Vellinga et al., 2003, the clade with *Macrolepiota* spec. nov. 1 and 4). The most obvious morphological difference between *Volvolepiota* and *Macrolepiota* is the presence of a volva in the former. Cylindrical cheilocystidia are found in *Volvolepiota* species and in *M. clelandii* Grgur. The spores in *Volvolepiota* are relatively small, not exceeding 15 µm, whereas *Macrolepiota* species (*Macrolepiota* is taken in the emended sense of Vellinga et al., 2003) have spores 11 µm and longer (up to 28.5 µm long in *M. clelandii*). The apparent absence of clamp-connections in *Volvolepiota* (though they are reported to be present in the stipe context (Singer, 1953)), is not unique; clamp-connections are difficult to find in *M. mastoidea* as well. More important are the similarities between the two: the trichodermal pileus covering (though with clavate and hyphal elements in *Volvolepiota brunnea* (Rick) Singer), the germ pore which is an interruption of the episporium, and the presence of a stipe covering. The differences do not warrant a separate genus, and *Volvolepiota* is accordingly considered a synonym of *Macrolepiota*, and the present new taxon is described as a member of the genus *Macrolepiota*.

A new name in *Macrolepiota* is necessary for *Volvolepiota brunnea*; *Macrolepiota pulchella* de Meijer & Vellinga, nom. nov., is proposed (basionym: *Lepiotella brunnea* Rick in Lilloa 2: 251. 1938, non *Macrolepiota brunnea* (Farlow & Burt) Wasser, 1993).

Macrolepiota brunnescens Vellinga, nom. nov., is proposed for *V. albida* Singer (basionym: *Volvolepiota albida* Singer in Bol. Soc. arg. Bot. 8: 12. 1959, non *Macrolepiota albida* (Beeli) Heinem., 1969). The name refers to the fact that the species is said to discolour brown in all parts (Singer, 1959).

Volvate *Macrolepiota* species appear to be widespread, and are now known from northeast Australia, southwestern China, and South America. They seem to have a more tropical distribution than the other *Macrolepiota* species. *Macrolepiota procera* (Vittad.) Singer and allies are widespread in temperate regions, and so are species of the complex around *M. mastoidea* (Fr.: Fr.) Singer.

The macroscopic description of the new species from China is based on the field notes of the second author and his photographs of the material. For microscopic examination the material was revived in Congo Red in 10 % ammonia solution. The notation [36, 3, 2] indicates that measurements were made on 36 spores in three samples in two collections. The following abbreviations are used: avl for average length, avw for average width, Q for quotient of length and width, and avQ for average quotient.

Macrolepiota velosa Vellinga & Zhu L. Yang, spec. nov. – Fig. 1.

Pileus squamis brunneis, et pannis volvatis albidis, stipes basi volvatus, sporae 8.0-10.0 x 6.0-7.0 µm, cheilocystidia 44-68 x 4.5-7.5 µm, cylindracea, fibulae non observatae. Typus hic designatus: "China, Yunnan Prov.: Jinghong, Damenglong, 14-VIII-1995, Z. L. Yang 2172 (Holotypus HKAS 29487; isotypus L)".

Pileus 7-9 cm, plano-convex with wide indistinct umbo, dark brown and tufted-plushy at centre, around centre with brown to dark brown squamules, sometimes with purplish tinge, on brownish to pale brownish or grey with purplish tinge, radially fibrillose background, and with white to dirty white membranous volval remnants as patches on the surface. Lamellae free and remote from stipe, not ventricose, whitish, with white cystidiose edge. Stipe 10-17 x 0.4-1.0 cm, cylindrical, widened at utmost base (up to 1.3 cm), brownish to purplish brown, paler at apex, finely fibrillose or squamulose, hollow. Annulus ascending, whitish on upperside with brown rim, and brownish underside. Volva limbate, white, membranous. Context in pileus white, in stipe white, with pinkish to brownish tinge. Smell indistinct. Taste indistinct or mild.

Spores [56, 5, 4] 8.0-10.0(-11.0) x 6.0-7.0 µm, avl x avw = 9.3 x 6.6 µm, Q = 1.3-1.5, avQ = 1.4, amygdaloid-ellipsoid in side-view, ellipsoid in frontal view, with thickened wall, with apical central germ pore, covered by a hyaline cap, congophilous, cyanophilous, dextrinoid, and metachromatic in Cresyl Blue. Basidia 25-30 x 9.5-11.5 µm, 4-spored, without clamp connection. Lamella edge sterile, made up of tightly

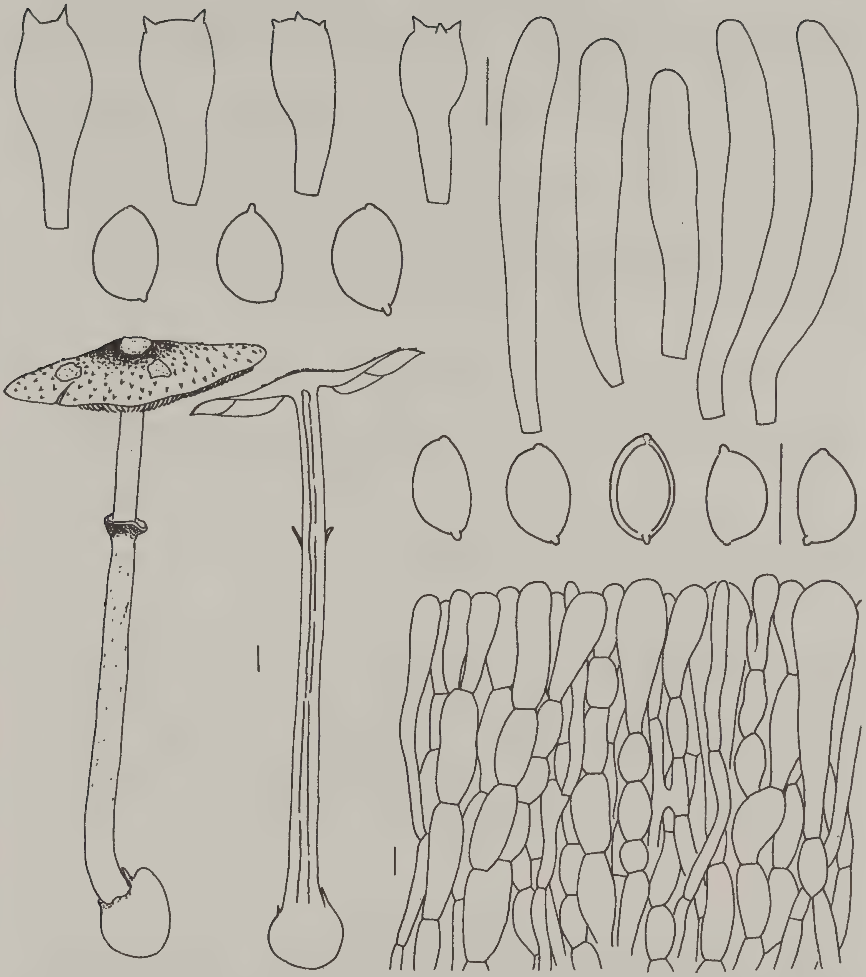

Fig. 1. *Macrolepiota velosa* – Habitus, spores, basidia, cheịlocystidia and pileus covering at centre of pileus. All from holotype. Bar 1 cm (habitus), 10 µm (microscopic structures).

packed cheilocystidia. Cheilocystidia 44-68 x 4.5-7.5 µm, cylindrical, some slightly widened at apex, with rounded apex, with greyish-granular contents, and refractive patch at apex. Pleurocystidia absent. Squamules on pileus made up of ellipsoid to subglobose brown-walled elements in chains; terminal elements up to 100 x 25 µm, often clavate or broadly clavate; some brown cylindrical hyphae, 5-8 µm in diameter present as well; squamules at centre rather regular (see Fig. 1), close to pileus margin more irregularly arranged, with a wider range of cell sizes. Velar patches made up of hyaline, non-coloured, cylindrical narrow hyphae, c. 2-4 µm wide. Stipitipellis a cutis of brown-coloured hyphae with irregular loose-lying, cylindrical hyphae, c. 5-10 µm in diameter. Clamp-connections not observed at base of basidia, cheilocystidia, nor in pileus covering and velum remnants.

Habitat & distribution. – Solitary, terrestrial in dry monsoon forest, in tropical limestone monsoon forest, and in tropical seasonal forest, 600-800 m a.s.l. Probably not uncommon in Yunnan.

Collections examined: China, Yunnan Prov., Jinghong, Damenglong, 14-VIII-1995, Z.L. Yang 2172 (Holotype HKAS 29487, isotype L) (nrITS sequence GenBank accession number AF482853); Mengla County, Menglun Nature Reserve, 12-VIII-1988, Z.L. Yang 381 (HKAS 21808); *ibidem*, 2-IX-1990, Z.L. Yang 1271 (HKAS 23312); Mengla County, Menglun, Botanical Garden, 21-X-1989, Z.L. Yang 767 (HKAS 22131).

Macrolepiota pulchella resembles *M. velosa*, but differs in forming longer spores (10-14.5 x 6.0-7.5 µm, personal observations), shorter cheilocystidia (23-42 µm long), and pileus squamules made up of clavate elements and long, colourless emerging hyphae. Heinemann & de Meijer (1996) gave an extensive description of *M. pulchella* (as *V. brunnea*).

Macrolepiota eucharis Vellinga & Halling, described from the rainforest of northeastern Australia, differs in bigger spores (10.8-15.5 x 7.0-9.0 µm), wider and shorter cheilocystidia (25-53 x 5.0-12 µm), and a different structure of the pileus covering, lacking ellipsoid to globose or clavate elements.

The basidiocarps of *Macrolepiota brunnescens*, described from Argentina (as *V. albida*), are less slender than those of *M. velosa*; both species have velar patches on the pileus. The spores of *M. brunnescens* are 9.5-11 x 6.5-8.5(-10) µm (Heinemann & de Meijer, 1996), versus 8.0-10.0 x 6.0-7.0 µm in *M. velosa*. In addition, *M. brunnescens* is said to discolour brown in all parts (Singer, 1959).

Macrolepiota clelandii Grgur. superficially resembles *M. velosa* because of the slender habit and the brown squamose pileus, but differs in the absence of a volva, the predominantly 2-spored basidia and the much bigger spores; even spores of 4-spored basidia measure 12.5-16.5 x. 8.5-10 µm; spores from 2-spored basidia are up to 28.5 x 15.5 µm.

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A STUDY OF PENIOPHORA SPECIES WITH SIMPLE-SEPTATE HYPHAE OCCURRING IN TAIWAN

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ABSTRACT

In this survey of Taiwanian *Peniophora* species with simple-septate hyphae, five species are presented: *P. bicornis, P. borbonica*, *P. malaiensis*, *P. reidii*, and *P. taiwanensis*. The first four species are newly recorded from Taiwan, and the last one is new to science. A key to the five species is given. Descriptions, line drawings, and results of cultural and cytological studies are also provided.

Keywords: Basidiomycota, Corticiaceae, cultural studies, new species, taxonomy.

INTRODUCTION

The genus *Peniophora* Cooke is generally regarded by mycologists as a member of the Corticiaceae s.l. (Basidiomycota). Parmasto (1997) recognized 81 species in this genus. A majority of species of this genus has nodose-septate hyphae in their basidiocarps. Only a few species of *Peniophora* bear simple-septate hyphae, mostly recorded from tropical and subtropical regions (Boidin et al., 1991). Wu (2002) recently reported *Peniophora* species in Taiwan with nodose-septate hyphae. This study presents a survey of the *Peniophora* species in Taiwan with simple-septate hyphae. Regularly nodose-septate hyphae are absent in basidiocarps of the five species studied; nevertheless, clamps are occasionally present in the cultured mycelia. This interesting phenomenon implies that the

Peniophora with simple-septate hyphae in the basidiocarps probably lost the ability to produce clamp connections in the course of evolution. Another distinct phenomenon with many of the species is the nucleus number, which is quite variable for basidiospores, monosporous mycelium, and polysporous mycelium. The new term "self-dikaryotic" nuclear behavior is proposed in this paper and is explained in the methods section.

MATERIALS AND METHODS

Specimens were collected in Taiwan from various localities during 1988-1995. Methods for dealing with specimens and examination of specimens, and general terms used for describing various characters, are explained in Wu (1990). All specimens cited, as well as living cultures, are deposited in the herbarium of the National Museum of Natural Science of Republic of China (TNM). Cultural description and species code system are from Nobles (1965) with amendments by Boidin and Lanquetin (1983). Nobles' code as detailed by Nakasone (1990) was adopted in this study. Methods of cultural and cytological studies are described in Wu (1996). Terminology for nuclear behavior is based on Boidin and Lanquetin (1984). A new term "self-dikaryotic" is proposed herein for those having uninucleate spores, dikaryotic MS-mycelium, and dikaryotic PS-mycelium. "Self-dikaryotic nuclear behavior" is new to the Nobles' code system compiled by Nakasone (1990), and is herein designated as code number 69. This peculiar nuclear behavior is fairly common in the studied group, but its mechanism is unknown at this moment. "Self-dikaryotic nuclear behavior" may be considered as deviation of "normal nuclear behavior". The reason is that *Peniophora* species with nodose-septate hyphae possess normal nuclear behavior. Moreover, *P. reidii* and *P. taiwanensis*, was detected in this study as having "probably normal" and "uncertainly normal" nuclear behavior, respectively.

TAXONOMY

Key to Known Species of Peniophora in Taiwan with Simple-Septate Hyphae

1. Basidia usually 2-sterigmate, sometimes 3- or 4-sterigmate .... *P. bicornis*
1. Basidia normally 4-sterigmate 2
2. Basidiospores > 8 µm long 4
2. Basidiospores < 8 µm long 3
3. Basidiospores > 2.2 µm wide .... *P. malaiensis*
3. Basidiospores < 2.2 µm wide .... *P. taiwanensis*
4. Basidiospores narrowly ellipsoid or cylindrical, 8.3-10.5 x 3-4.6 µm .... *P. reidii*
4. Basidiospores suballantoid or cylindrical, 8-10.5 x 2.7-3.5 µm .... *P. borbonica*

1. *Peniophora bicornis* Hjortstam & Ryvarden, Mycotaxon 20: 138. 1984 (Figure 1)

Basidiocarp resupinate, effuse, adnate, membranaceous, 30-250 µm thick in section. Hymenial surface grayish brown, smooth, cracked when old; margin fairly determinate or slightly thinning, concolorous.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, composed of a basal layer, with compact texture; hyphae brownish, mainly horizontal, sometimes glued together, 2-4 µm diam, with 0.5-1 µm thick walls. Hymenium thickening. Hymenial layer with compact texture; hyphae brownish-tinted, mainly vertical, thin-walled. Lamprocystidia numerous, immersed or emergent, overlapping in thicken hymenial layer, heavily encrusted, conical or subulate, yellow to brown, 25-40 x 8-11 µm (encrustation included), with 1.5-3 µm thick walls. Gloeocystidia colorless, cylindrical, usually tapering toward apices, 25-45 x 4-7 µm, thin- to slightly thick-walled, SA-. Basidia subclavate, 18-30 x 4.5-6 µm, usually thick-walled toward base, usually 2-sterigmate, sometimes 3- or 4-sterigmate. Basidiospores ellipsoid, adaxially slightly concave, smooth, thin-walled, 6-8.5 x 3.2-4.2 µm, IKI-, CB-.

Specimens examined. **TAIWAN.** TAIPEI: National Taiwan University, on branch of *Elaeocarpus sylvestris*, 23.VI.1988, *Wu 880623*; on stem of living *Euphorbia pulcherrima*, 13.X.1988, *Wu 881013-3*; on branch of *Ligustrum japonicum*, 2.XII.1990, *Wu 901202*. NANTOU: Hsitou, alt. 1200 m, on branch of angiosperm, 27.VII.1993, *Wu 9307-68*. TAINAN: Kuantsilin, alt. 500 m, on branch of living *E. pulcherrima*, 20.IX.1991, *Wu 910920-5*. KAOHSIUNG: Liukuei, Shanping, alt. 750 m, on branch of angiosperm, 7.XI.1991, *Wu 911107-46*; on branch of *Pisonia aculeate* (?), 22.XII.1993, *Wu 9312-50*.

Distribution. Nepal (type locality), Gabon, Reunion Island, Singapore (Boidin et al., 1991), Taiwan.

Cultural description (PS-mycelium of *Wu 911107-46*). 1 wk growth: Colony radius 40 mm. Advancing zone even. Mat white. Aerial mycelium pellicular around inoculum, downy-cottony toward plate margin. Advancing hyphae colorless, nodose- or simple-septate, 2-6 µm diam., thin-walled. 2 wk growth: Plates covered. Mat white. Aerial mycelium pellicular-downy around inoculum, downy-cottony elsewhere. 6 wk growth: Mat white. Aerial mycelium pellicular near inoculum, pellicular-downy elsewhere. Hyphal system monomitic. Aerial hyphae sparsely or moderately branched, colorless, simple- or nodose-septate, usually guttulate, 1.5-4 µm diam, thin- or slightly thick-walled; gloeoplerous hyphae colorless, 3-5.5 µm diam, thin- to thick-walled, SA-; gloeocystidia colorless, irregularly swollen and with constrictions, up to 12 µm diam, with walls up to 3 µm thick, SA-. Submerged hyphae colorless, moderately or sparsely ramified, usually guttulate, 1.5-4 µm diam, thin- or slightly thick-walled, secondary septa occasional; gloeoplerous hyphae or gloeocystidia colorless, irregularly swollen and frequently constricted as moniliform, up to ca. 12 µm diam, with slightly thick to very thick walls (up to 5 µm). No distinct odor. Not fruiting.

Oxidase reactions. TAA +++, 38-43; 72-76. GAA ++++, 23-26; 40-45. TyA -, 52-58; 90+.

Nuclear behavior. Uncertainly holomonokaryotic. Spores uninucleate. Two of the three studied MS-mycelia are monokaryotic, and the third bears both monokaryotic and dikaryotic cells; hyphae of all three studied MS-mycelia are generally simple-septate, rarely nodose-septate. PS-mycelium monokaryotic; hyphae generally simple-septate, rarely nodose-septate (*Wu 911107-46*). Boidin et al. (1991) reported the same nucleus number for spores and MS-mycelium of this species, but their study showed PS-mycelium of this species having dikaryotic cells. They regarded this species as having "normal nuclear behavior".

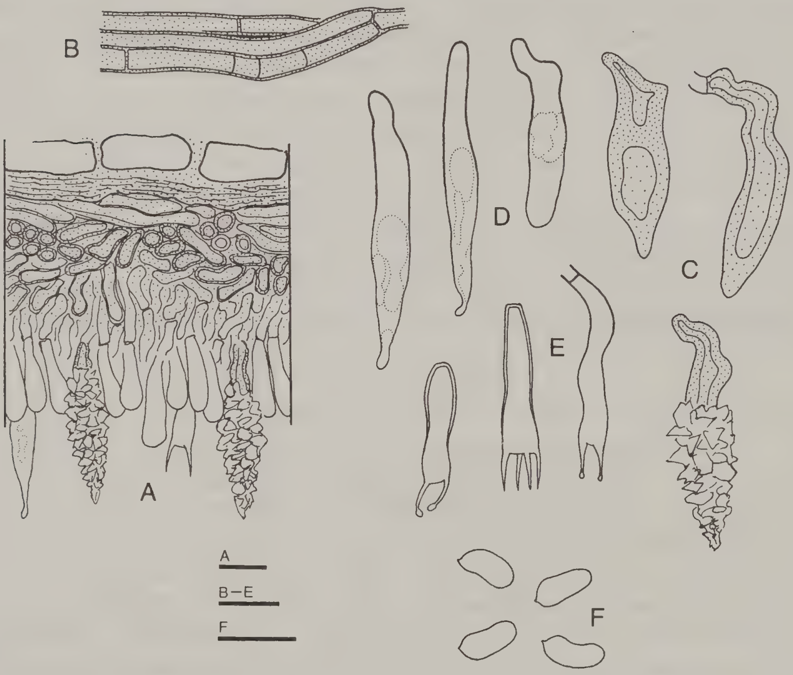

Figure 1. *Peniophora bicornis* (*Wu 911107-46*). A. Basidiocarp section. B. Subicular hyphae. C. Lamprocystidia (upper: without encrustation; below: with encrustation). D. Gloeocystidia. E. Basidia. F. Basidiospores. Scale bars = 10 μm.

Sexuality. Presumed homothallic (Boidin et al., 1991).

Species code. 2a, 3i, 15b, 15p, 32, 36, 38, 42, 54, (57), (67).

Remarks. This species is distinct in having mainly 2-sterigmate basidia.

2. *Peniophora borbonica* Boidin & Gilles, Mycotaxon 75: 374. 2000 (Figure 2)

Basidiocarp resupinate, effuse, adnate, membranaceous, 50-120 µm thick in section. Hymenial surface purplish gray or gray, smooth, rarely cracked; margin thinning or determinate, brown.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, composed of a basal layer, with compact texture; hyphae brownish, mainly horizontal, usually glued together, 2.5-4 µm diam, with 0.5-1 µm thick walls. Hymenium ± thickening. Hymenial layer with compact texture; hyphae colorless toward hymenium, slightly brown near subiculum, mainly vertical, thin- or slightly thick-walled. Lamprocystidia mostly immersed, heavily encrusted, conical, yellow or brown, 30-50 x 12-18 µm (encrustation included), with 1-3 µm thick walls. Gloeocystidia colorless, yellow, or slightly brown, cylindrical, quite often tapering to acute apices, 30-60 x 7-12 µm, thick-walled toward bases, SA-. Basidia subclavate or cylindrical, 25-40 x 4.5-5.7 µm, usually thick-walled toward base, 4-sterigmate. Basidiospores suballantoid, or cylindrical, adaxially slightly concave, smooth, thin-walled, 8-10.5 x 2.7-3.5 µm, IKI-, CB-.

Specimens examined. **TAIWAN.** TAIPEI: National Taiwan University, on branch of *Machilus zuihoensis*, 26.VIII.1989, *Wu 890826*. NANTOU: Sunlinksea, alt. 1,600 m, on branch of *Liquidambar formosana*, 19.IX.1992, *Wu 9209-47*; on branch of angiosperm, *Wu 9209-62*. KAOHSIUNG: Liukuei, Shanping, alt. 750 m, on branch of *Euphoria longana*, 7.XI.1991, *Wu 911107-20*.

Distribution. Reunion Island (type locality; Boidin and Gilles, 2000), Taiwan.

Cultural description (PS-mycelium of *Wu 911107-20*). 1 wk growth: Colony radius 34-36 mm. Mat white to brown. Advancing zone even. Aerial mycelium pellicular. 2 wk growth: Plates partly covered. Mat white to brown. Advancing zone even. Aerial mycelium generally pellicular, slightly crustose. 3 wk growth: Plates covered. 6 wk growth: Mat whitish to brown. Aerial mycelium generally pellicular, slightly crustose, occasionally granular. No distinct odor. Agar bleached or turning brown. Not fruiting by 6 wk. Hyphal system monomitic. Advancing hyphae nodose- or simple-septate, colorless, 1.5-6 µm diam, thin-walled. Aerial hyphae colorless or brownish yellow, mostly simple-septate, rarely nodose-septate, moderately or richly branched, 1-3 µm diam, thin-walled. Submerged hyphae colorless, rarely slightly brown, usually guttulate, mostly simple-septate, rarely nodose-septate, moderately branched, occasionally swollen, 2-7 µm diam, thin-walled. Crystals present. No distinct odor. Not fruiting.

Oxidase reactions. TAA: +++, 30-44; +++, 42-68. GAA: +, tr; +++, tr. TyA: - (pale brown), 52-58; - (pale yellow, pale brown around inoculum), 90+.

Nuclear behavior. Self-dikaryotic. Spores uninucleate. MS-mycelium dikaryotic, with simple-septate hyphae. PS-mycelium dikaryotic; hyphae generally simple-septate, rarely nodose-septate (*Wu 911107-20*). Cytological study of the same species reported by Boidin and Gilles (2000) corresponds with this study.

Sexuality. Presumed homothallic.

Species code. 2a, 3i, 7, 32, 36, 37, 39, 40, (42), 54, (57), 69.

Remarks. This species is very close to *P. reidii* due to similar morphological features. The latter has slightly wider basidiospores (3-4.6 μm) than the former (2.7-3.5 μm). Overlap of spore width exists between these two species. *Peniophora borbonica* has uninuleate basidiospores, while basidiocarp of *P. reidii* bears both uninucleate and binucleate basidiospores. Further studies of more collections and analysis of DNA sequences can be performed to clarify their specific separation.

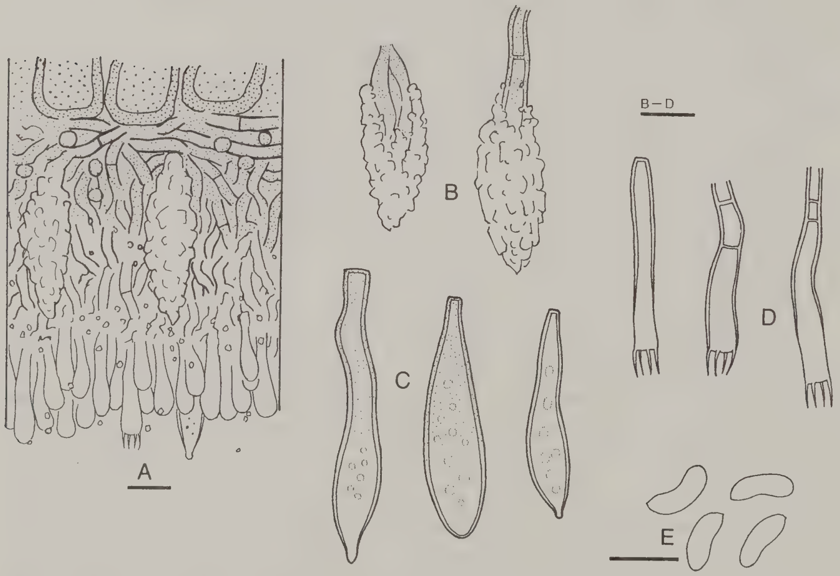

Figure 2. *Peniophora borbonica* (*Wu 911107-20*). A. Basidiocarp section. B. Lamprocystidia. C. Gloeocystidia. D. Basidia. E. Basidiospores. Scale bars = 10 μm.

3. ***Peniophora malaiensis*** Boidin, Lanquetin & Gilles, Bull. Soc. Mycol. France 107: 1991 (Figure 3)

Basidiocarp resupinate, effuse, adnate, membranaceous, 40-120 μm thick in section. Hymenial surface pinkish gray, smooth, occasionally cracked; margin thinning, concolorous.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, composed of a basal layer, with compact texture; hyphae brownish, horizontal, usually glued together, 2-3.5 μm diam, thick-walled. Hymenium ± thickening. Hymenial layer with compact texture; hyphae colorless toward hymenium, slightly brown near subiculum, mainly vertical, thin- or slightly thick-walled. Lamprocystidia mostly immersed, heavily encrusted, conical, yellow or brownish, 20-35 x 8-16 μm (encrustation included), with 1-2.5 μm thick walls. Gloeocystidia numerous, colorless, yellow or slightly brown, cylindrical, usually tapering to acute apices, 25-55 x 6-11 μm, thick-walled toward bases, SA+. Basidia subclavate or cylindrical, 25-35 x 4-5 μm, 4-sterigmate. Basidiospores suballantoid, smooth, thin-walled, 6-7.2 x 2.2-3 μm, IKI-, CB-.

Specimens examined. **TAIWAN.** TAIPEI: Yangminshan, alt. 450 m, on branch of angiosperm, 1.VII.1988, *Wu 880701-12*. Roadside between Hsintien and Pinglin, alt. 700 m, on branch of angiosperm, 17.VIII.1989, *Wu 890817-3*. Kungliao, alt. 200 m, on branch of angiosperm, 25.VII.1991, *Wu 910725-12 & Lin 558*. ILAN: Fushan Botanical Garden, on branch of angiosperm, 7.VIII.1991, *Wu 910807-13 & -20*; 30.IX.1995, *Wu 9509-44*. NANTOU: Lienhuachih, alt. 700 m, on branch of angiosperm, 5.VII.1993, *Wu 9307-30 & -34*. Neimaopu, Tachieshan, alt. 750 m, on branch of angiosperm, 13.X.1994, *Wu 9410-18*. PINGTUNG: Kenting National Park, Nanjenshan, alt. 150 m, on branch of angiosperm, *Wu 9206-37*; on branch of *Cyclobalanopsis globosa*, 16.VI.1992, *Wu 9206-41*; Chufengshan, alt. 100 m, on branch of angiosperm, *Wu 9408-24 & -31*.

Distribution. Singapore (type locality), Taiwan.

Cultural description (PS-mycelia of *Wu 9206-41* and *Wu 9307-30*). 1 wk growth: Colony radius 30-35 mm. Advancing zone even. Mat white. Aerial mycelium pellicular around inoculum, downy elsewhere. 2 wk growth: Colony radius 70-75 mm. Advancing zone fairly even. Mat white. Aerial mycelium pellicular-downy around inoculum, downy-cottony elsewhere. 3 wk growth: Plates covered. 6 wk growth: Mat white, slightly brownish lining the plate margin. Aerial mycelium pellicular close to inoculum, pellicular-downy toward plate margin. Hyphal system monomitic. Aerial hyphae moderately or sparsely branched, colorless, generally nodose-septate, usually guttulate, 1.5-4.5 μm diam, thin-walled; capilliform hyphae occasionally present (in *Wu 9206-41*), colorless, ramified, 1-2 μm diam, slightly thick-walled; gloeoplerous hyphae occasionally present (in *Wu 9307-30*), colorless, frequently constricted, 4-10 μm diam, walls up to 2 μm thick, SA-. Submerged hyphae colorless, moderately or sparsely ramified, generally simple-septate, rarely nodose-septate, 1.5-5 μm diam, thin-walled, secondary septa frequent; gloeoplerous hyphae abundant (in *Wu 9307-30*), colorless, irregularly swollen and frequently constricted, quite often with short branches, 4-10 μm diam, walls up to ca. 2 μm thick, SA-. No distinct odor. Not fruiting.

Oxidase reactions. TAA +++ to ++++, 28-53; (90+). GAA ++++, 23-33; 40-60. TyA -, 55-65; 90+.

Nuclear behavior. Probably self-dikaryotic. Spores uninucleate. Two of the three studied MS-mycelia are dikaryotic, and the third is monokaryotic; hyphae of the three studied MS-mycelia are generally simple-septate, rarely nodose-septate. PS-mycelium dikaryotic; hyphae simple-septate (*Wu 9206-41*). Boidin et al. (1991) reported the same nucleus number for spores and PS-mycelium of this species, but they only detected monokaryotic hyphae from MS-mycelium. They regarded this species as "normal nuclear behavior".

Sexuality. Heterothallic (Boidin et al., 1991).

Species code. 2a, 3i, (8), (15b), (15p), 32, 36, 37, 38, 43, 54, 58, (69).

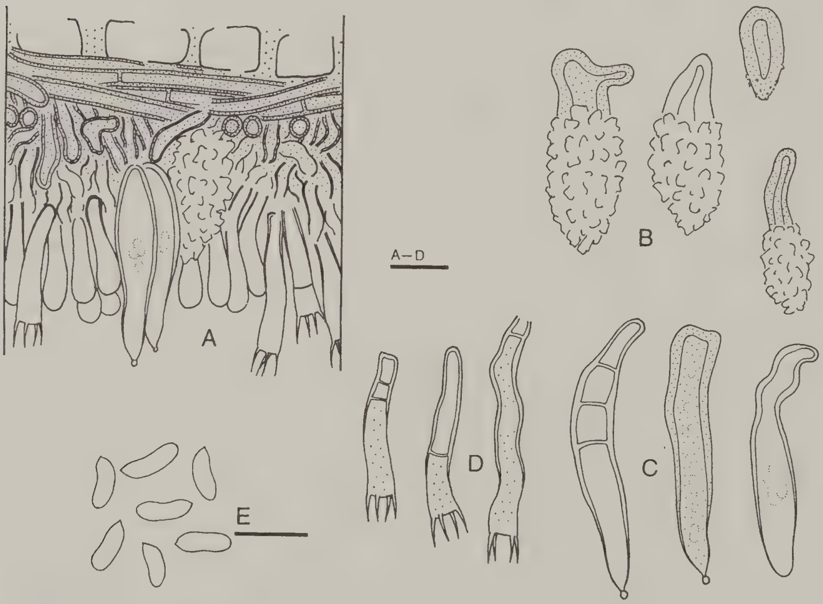

Figure 3. *Peniophora malaiensis* (*Wu 9206-41*). A. Basidiocarp section. B. Lamprocystidia. C. Gloeocystidia. D. Basidia. E. Basidiospores. Scale bars = 10 μm.

Remarks. This species is very close to *P. taiwanensis*. See discussion in the remarks of the latter.

4. *Peniophora reidii* Boidin & Lanquetin, Trans. British Mycol. Soc. 81: 279. 1983 (Figure 4)

Basidiocarp resupinate, effuse, adnate, membranaceous, 50-100 μm thick in section. Hymenial surface brownish gray, smooth, minutely cracked; margin thinning, concolorous or brownish.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, composed of a basal layer, with compact texture; hyphae brownish, mainly horizontal, glued together, 2-4 μm diam, ± thick-walled. Hymenium ± thickening. Hymenial layer with compact texture; hyphae brownish or yellowish, mainly vertical, slightly thick-walled. Lamprocystidia immersed or emergent, heavily encrusted, conical or subulate, usually brown, 25-45 x 9-15 μm (encrustation included), with 1-2.5 μm thick walls. Gloeocystidia not very common, colorless or slightly brown, subulate or conical, with brownish oily contents, 20-45 x 5-8 μm, slightly thick-walled toward base, SA-. Basidia subclavate, 25-38 x 5-6 μm, usually with thickened walls toward base, 4-sterigmate. Basidiospores narrowly ellipsoid or cylindrical, adaxially slightly concave, smooth, thin-walled, 8.3-10.5 x 3-4.6 μm, IKI-, CB-.

Specimens examined. **TAIWAN.** TAIPEI: Highway between Hsintien and Pinglin, Wenshan Botanical Garden, alt. 300 m, on branch of *Paulownia fortunei*, 27.IV.1991, *Wu 910427-6*. Yangminshan, alt. 600 m, on branch of angiosperm, 24.VII.1991, *Wu 910724-11*. Chiayi: Yushan National Park, Nanhsilintao, alt. 2,200 m, on branch of angiosperm, 14.X.1993, *Wu 9310-115*.

Distribution. Great Britain (type locality), France, Spain (Boidin and Lanquetin, 1983a), and Taiwan.

Cultural description (PS-mycelium of *Wu 9310-115*). 1 wk growth: Colony radius 26-28 mm. Advancing zone fairly even. Mat white. Aerial mycelium cottony. 2 wk growth: Colony radius 56-59 mm. Advancing zone fairly even. Mat white. Aerial mycelium pellicular-downy around inoculum, downy-cottony toward plate margin. 3 wk growth: Plates covered. 6 wk growth: Mat generally white, slightly brownish-tinted. Aerial mycelium pellicular near inoculum, downy-cottony elsewhere. Hyphal system monomitic; hyphae simple-septate. Aerial hyphae colorless, sparsely ramified, 1.5-3.5 μm diam, thin-walled; gloeocystidia and gloeoplerous hyphae present, colorless, 3-7 μm diam, usually slightly thick- or thick-walled, SA-. Submerged hyphae colorless, moderately ramified, 1.5-6 μm diam, thin-walled. Crystals present. Odor of cinnamon. Not fruiting.

Oxidase reactions. TAA ++++, 25-30; 60-65. GAA ++++, 10-12; 15-22. TyA -, 38-43; 55-60.

Nuclear behavior. Probably normal. Spores almost equally uninucleate or binucleate.

Three of the four studied MS-mycelia have both dikaryotic and monokaryotic hyphae, and one MS-mycelium is dikaryotic; hyphae of the studied MS-mycelia are generally simple-septate, rarely nodose-septate. PS-mycelium dikaryotic; hyphae simple-septate (*Wu 9310-115*). Boidin and Lanquetin, 1983a) reported spores of this species are generally uninucleate and rarely binucleate. They reported both MS-mycelium and PS-mycelium of this species are generally dikaryotic, and one or three nuclei were rarely found in the cells. They reported that this species has “normal nuclear behavior”.

Sexuality. Presumed homothallic (Boidin and Lanquetin, 1983a).

Species code. 2a, 6, 15b, 32, 38, 43, 54, (57), (61).

Remarks. This species is very close to *P. borbonica*, and their similarities are mentioned above.

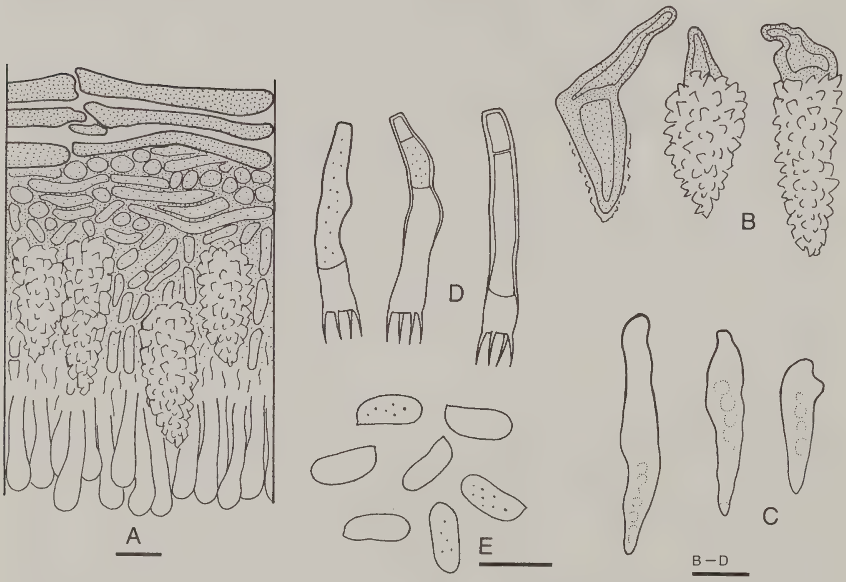

Figure 4. *Peniophora reidii* (*Wu 910427-6*). A. Basidiocarp section. B. Lamprocystidia. C. Gloeocystidia. D. Basidia. E. Basidiospores. Scale bars = 10 μm.

5. *Peniophora taiwanensis* Sheng H. Wu, sp. nov. (Figure 5)

Basidiocarpus effusus, membranaceus, 40-120 µm crassus; superficies hymenialis plana. Systema hypharum monomiticum; hyphae efibulatae. Lamprocystidia numerosa, conica, 15-35 x 6-10 µm. Gloeocystidia cylindrica, 20-60 x 5-10 µm. Basidia subclavata, 20-30 x 3.5-4.3 µm, 4 sterigmatibus. Basidiosporae suballantoideae, laeves, tenuitunicatae, 5-7 x 1.8-2.2 µm, IKI-, CB-.

Holotype. **TAIWAN.** PINGTUNG: Kenting, Chufengshan, alt. 250 m, on branch of angiosperm, 17.VI.1992, *Wu 9206-69* (holotype, TNM).

Etymology. From Taiwan, referring to the island where this new species was found.

Basidiocarp resupinate, effuse, adnate, membranaceous, 40-120 µm thick in section. Hymenial surface lilac-gray to brownish gray, smooth, rarely cracked; margin fairly determinate, of a narrow brown immature zone.

Hyphal system monomitic; hyphae simple-septate. Subiculum fairly uniform, composed of a basal layer, with compact texture; hyphae brownish, horizontal, usually glued together, 2-4 µm diam, usually thick-walled. Hymenium ± thickening. Hymenial layer with compact texture; hyphae brownish or yellow, mainly vertical, slightly thick-walled. Lamprocystidia numerous, heavily encrusted, conical, yellow or brownish, 15-35 x 6-10 µm (encrustation included), with 1-2.5 µm thick walls. Gloeocystidia colorless, yellow or slightly brown, cylindrical, narrow toward apices or with acute apices, 20-60 x 5-10 µm, thick-walled except apices, ± SA+. Basidia subclavate, usually thick-walled toward bases, 4-sterigmate, 20-30 x 3.5-4.3 µm, 4-sterigmate. Basidiospores suballantoid, smooth, thin-walled, 5-7 x 1.8-2.2 µm, IKI-, CB-.

Additional specimens examined. **TAIWAN.** TAIPEI: Yangminshan, alt. 450 m, on branch of angiosperm, 1.VII.1988, *Wu 880701-29*; alt. 600 m, on branch of angiosperm, 1.VII.1988, *Wu 910724-13*, *-29* & *-33*. Kungliao, alt. 200 m, on branch of *Liquidambar* sp., 25.VII.1991, *Lin 530*; on branch of angiosperm, *Wu 910725-15*. ILAN: Fushan, alt. 600 m, on branch of angiosperm, 7.VIII.1991, *Wu 910807-18*; 8.VIII.1991, *Wu 910808-49*. NANTOU: Lienhuachih, alt. 700 m, on branch of angiosperm, 5.VII.1993, *Wu 9307-43*. KAOHSIUNG: Liukuei, Shanping, alt. 750 m, on branch of angiosperm, 7.VII-1991, *Wu 911107-1*. PINGTUNG: Kenting, Nanjenshan, alt. 150 m, on branch of angiosperm, 16.VI.1992, *Wu 9206-28*.

Distribution. Known only from Taiwan.

Cultural studies (PS-mycelia of *Wu 9206-28* and *Wu 9206-69*). 1 wk growth: Colony radius 20-30 mm. Mat white. Advancing zone even. Aerial mycelium pellicular to downy. 2 wk growth: Colony radius 47-72 mm. Mat generally white, pale brown around inoculum. Advancing zone fairly even. Aerial mycelium pellicular to downy. 3 wk growth: Plates partly covered. 6 wk growth: Plates covered. Mat white or pale brown. Aerial mycelium pellicular. Agar turning pale brown. No distinct odor. Not fruiting. Hyphal system monomitic. Advancing hyphae colorless, 2-6 µm diam, thin-walled, simple-septate. Aerial hyphae generally colorless, occasionally brownish yellow, sparsely or moderately branched, simple- or nodose-septate, 1.5-3.5 μm diam, thin-walled. Submerged hyphae colorless, moderately branched, simple-septate, 2-6 μm diam, thin-walled. Crystals present.

Oxidase reactions. TAA: +++, 30-45; +++, 60-80. GAA: ++++, 8-18; ++++, 18-26. TyA: -, 47-60; - (yellow), 90+.

Nuclear behavior. Uncertainly normal. Spores uninucleate. One studied MS-mycelium mostly monokaryotic, rarely dikaryotic; hyphae simple-septate. PS-mycelium dikaryotic; hyphae generally simple-septate, rarely nodose-septate (*Wu 9206-69*).

Sexuality. Uncertainly heterothallic.

Species code. 2a, 3i, 7, 32, 36, 37, 39, (43), 54, (58), (61).

Remarks. This new species is allied to *P. malaiensis*. Both are fairly common in tropical and subtropical Taiwan, but *P. taiwanensis* has narrower basidiospores than *P. malaiensis*.

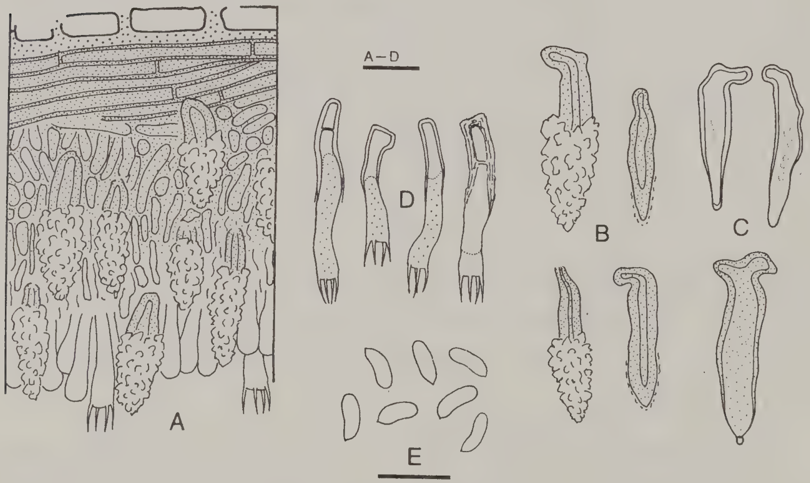

Figure 5. *Peniophora taiwanensis* (*Wu 9206-69*). A. Basidiocarp section. B. Lamprocystidia. C. Gloeocystidia. D. Basidia. E. Basidiospores. Scale bars = 10 μm.

Acknowledgments. The author is indebted to Dr. Boidin for taxonomic discussion, including the new term "self-dikaryotic nuclear behavior". Dr. K.K. Nakasone carefully reviewed this article. This study was supported by the National Science Council of ROC (Nos. NSC 83-0211-B-178-002 and NSC 90-2311-B-178-002).

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TYPE STUDIES ON PHELLINUS BAUMII AND PHELLINUS LINTEUS

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ABSTRACT

Phellinus linteus is famous for its anti-tumor activity and has been widely reported in Korea. Investigation of samples from China, Korea, Costa Rica, and Mexico revealed that the temperate East Asian species known as *P. linteus* is actually *P. baumii*. Morphological characters differentiating the two species were the sizes of pores and basidiospores and the thickness of spore walls. To improve the method for discriminating between the two species, molecular approaches were carried out through direct amplification and restriction enzyme digestion of ITS sequences. All the strains of *P. baumii* showed no polymorphism, but those of *P. linteus* were digested by *Dra*I and *Hpa*II and formed unique restriction patterns, suggesting that RFLP analysis of ITS can be used as an efficient typing method to differentiate the two look-alike species, *P. baumii* and *P. linteus*.

Key words: ITS, restriction enzyme, RFLP

INTRODUCTION

Wood-rotting fungi have been used for medicinal purposes since ancient times. A well-known and widely used one in Asian countries is a member of *Phellinus* that was taxonomically confirmed as *Phellinus baumii* Pilát by Dai and Xu (1998). This medicinal fungus is called sangwhang mushroom in Korea and is famous for its antitumor activity that has been proved to be highly effective for some cancer treatments. As the medicinal and commercial value of this fungus increases, its natural fruitbodies have come to fetch high prices at medicinal herb markets. Many mushroom growers have tried to cultivate this fungus and, as a result, it is now successfully cultivated in Korea (Dai, 1999; Dai and Xu, 1998; Song *et al.*, 1997) and widely used as an alternative medicine for cancer patients.

Owing to morphological similarity and conservative species concept, *P. baumii* has been dealt with as one of the synonyms for *P. linteus* (Berk. et M.A. Curt.) Teng for a long time. Its anti-tumor properties and polysaccharide chemicals have been studied under the name of *P. linteus* (Ikekawa *et al.*, 1968; Lee *et al.*, 1996; Maeda *et al.*, 1976; Song *et al.*, 1995) and *P. baumii* was not used as an independent name until Dai and Xu (1998) taxonomically discriminated the former from the latter. Such fungi collected in Korea used to be identified as *P. linteus*. However, recent application of morphological species concept to those two taxa after Dai and Xu (1998) led the authors to the conclusion that Korean *P. linteus* was actually *P. baumii*.

Geographically, *P. linteus* is mostly reported from tropical American and African regions and grows on many host plants of dead hardwoods (Dai and Xu, 1998; Gilbertson and Ryvarden, 1987; Larsen and Cobb-Poulle, 1990), while *P. baumii* is widely distributed in temperate Asia and lives mostly on *Syringa* and *Lonicera* in Northeast Asia (Dai and Xu, 1998; Núñez and Ryvarden, 2000; Parmasto and Parmasto, 2001). In addition to their different geographical distribution and host trees, some macro- and micro-morphological characters are used to tell those two species apart (Dai and Xu, 1998; Núñez and Ryvarden, 2000; Parmasto and Parmasto, 2001). Nevertheless, the accurate identification of this medicinal fungus remains difficult because intermediate types between those two species are sometimes encountered.

From the established usage of the name *P. linteus*, many people in Korea still believe that their medicine, sangwhang mushroom, is *P. linteus*. As a result, medicinal materials labeled as *P. linteus* have been imported from China and North Korea starting five years ago. The important fact is that many of imported materials are mixed collections loaded with *P. baumii* and one or more similar species that have not been taxonomically verified. There has been a need for a reliable method of rapid and accurate typing of those two *Phellinus* species until recently.

For this reason, Kim *et al.* (1999) and Park *et al.* (2001) developed ITS-specific primers for *P. linteus* without a taxonomic concept of those two taxa and thus a new primer design working for a single taxon is still required. To solve this problem, the authors developed a new PCR-RFLP analysis method using the variable ITS region. This method is simpler and faster than direct sequence comparisons and suitable for molecular typing of morphologically puzzling taxa. In addition, this method is sensitive enough to study intraspecific variation (Schulze *et al.*, 1997) and to identify closely related species (Erland *et al.*, 1994; Sanders *et al.*, 1995). In this work, the authors investigated collections with different geographical origins and evaluated the potential of

PCR-RFLP method to discriminate between *P. baumii* and its kin, *P. linteus* at the molecular level.

MATERIALS AND METHODS

Sources, microscopic observation and DNA preparation:

Nineteen fungal strains of three species used in this study are listed in Table 1 and deposited in the SFC (Seoul National University Fungus Collection). Three specimens from Russia (TAA 104264), Mexico (SFC 990520-1), and Costa Rica (SFC 990520-2) were donated by Ryvarden (University of Oslo, Norway). For observation of the specimens, the laboratory techniques of Largent *et al.* (1977) were employed. Measurements and drawings were made from slide preparations stained with 1 % (w/v) aqueous phloxine and 3% KOH (Hawksworth *et al.*, 1995; Jung, 1987). Genomic DNA was extracted from the specimens according to the protocol of Lecellier and Silar (1994) with some modification (Lee *et al.*, 2000). Extracted DNA was stored at -20℃ until required.

PCR amplification and restriction enzyme digestion of DNA:

PCR was accomplished to amplify the ITS region using the primers ITS1 (White *et al.*, 1990) and LW1 (Jeong, 1999) as described by Lee *et al.* (2000). PCR products were digested using seven restriction endonucleases to obtain RFLPs. Ten μl of amplified PCR reaction mixture was added to the restriction reaction buffer and 10 U of restriction enzyme to make 15 μl per sample and then incubated for 4 h at 37℃. Each sample was cut into single enzyme digests by four-base cutting (*Cfo*I, *Hpa*II, *Rsa*I) and six-base cutting (*Apa*I, *Bam*HI, *Dra*I, *Pst*I) restriction enzymes. Restriction fragments were separated by electrophoresis on 1% agarose gel in TAE buffer with EtBr of 100 ng/ml. Sizes of fragment DNAs were determined in comparison with a 1-kb Plus DNA molecular weight marker (Life Technologies, U. K.).

RESULTS AND DISCUSSION

Morphological features of *P. baumii*:

Basidiocarps perennial, sessile, semicircular, mostly ungulate, sometimes imbricate, up to 10 cm long, 11 cm wide, 5 cm thick at the base, woody hard; pileal surface dark grayish brown to dark gray, concentrically zonate, radially rimose and cracking, sometimes covered with mosses; margin blunt or rounded; hymenophores golden yellow when young, dark brown when old, forming a distinct and wide sterile zone along the margin; pores regular, circular, 8-10(-12) per mm; tube layers receding in old basidiocarps; context woody.

Hyphal system dimitic; generative hyphae simple-septate, hyaline to golden yellow, 2.0-2.3 μm wide; skeletal hyphae golden yellow to golden ferrugineous, thick-

Table 1. List of *Phellinus* strains examined in this study.

Scientific name	Deposit number	Condition[a]	Locality	Country	Host	Distribution
Phellinus baumii	SFC[b] 930719-15	N	Kwangneung, Gyeonggi-do	Korea	*Symplocos chinensis*	temperate zone
	SFC 940818	N	Andong, Gyeongsangbuk-do	Korea	*Hemiptelea davidii*	temperate zone
	SFC 960406-4	N	Mt. Jiri, Jeollanam-do	Korea	*Morus bombycis*	temperate zone
	SFC 960708	N	Yunnan Province	China	*Morus bombycis*	temperate zone
	SFC 961121	C	Andong, Gyeongsangbuk-do	Korea	*Quercus* sp.	temperate zone
	SFC 970218-01	N	Yangyang, Gangwon-do	Korea	*Morus bombycis*	temperate zone
	SFC 970605-01	N	Hwanghae-do	North Korea	*Morus bombycis*	temperate zone
	SFC 970611-08	N	Hwanghae-do	North Korea	*Morus bombycis*	temperate zone
	SFC 960405-04	N	Mt. Jiri, Jeollabuk-do	Korea	*Morus bombycis*	temperate zone
	SFC 990322	C	-	Korea	*Quercus* sp.	temperate zone
	SFC 990508	C	Suwon, Gyeonggi-do	Korea	*Quercus* sp.	temperate zone
	SFC 20000111-10	N	Mt. Worak, Chungcheongbuk-do	Korea	*Lonicera* sp.	temperate zone
	SFC 20001106-1	C	Mungyeong, Gyeongsangbuk-do	Korea	*Morus bombycis*	temperate zone
	SFC 20001106-2	C	Mungyeong, Gyeongsangbuk-do	Korea	*Morus bombycis*	temperate zone
	SFC 20001106-4	C	Andong, Gyeongsangbuk-do	Korea	*Quercus* sp.	temperate zone
	SFC 20001106-7	C	Andong, Gyeongsangbuk-do	Korea	*Quercus* sp.	temperate zone
Phellinus lonicerinus	TAA[c] 104264	N	Kovluk-Sai	Russia	*Lonicera* sp.	temperate zone
Phellinus linteus	SFC 990520-1	N	Huajuapan de Leon, Oaxaca	Mexico	-	subtropical zone
	SFC 990520-2	N	Saula, Rosa	Costa Rica	-	subtropical zone

[a] C: Cultivated strain, N: Natural strain.

[b] Seoul National University Fungus Collection.

[c] Herbarium Instituti Zoologici et Botanici Academiae Scientiarum Rei Publicae Estonicae.

walled, up to 4 μm wide; hymenial setae frequent to scanty, ventricose with an acute apex, thick-walled at the base, 21-25 x 6-11 μm; basidia clavate, 8-11.5 x 6-7 μm, with four sterigmata; basidiospores broadly ellipsoid to subglobose, hyaline at first, pale yellowish brown when mature, thin-walled, 3.5-4.6 x 2.5-3.4 μm.

This species is often difficult to distinguish from other closely related taxa due to similar morphological appearance. In addition, according to growth conditions, its appearance and size become quite variable. The host range of *P. baumii* from Korea seems fairly broad and grows on trees like *Morus*, *Quercus*, *Symplocos*, *Hemiptelea*, or *Lonicera* (Table 1). However, the pore size is consistently very small, reaching 8-10 per mm or sometimes up to 12 per mm, and the pore surface appears almost smooth to the naked eye, while *P. linteus* has 6-8 pores per mm, which are in agreement with the results of Dai and Xu (1998). Microscopically, basidia and basidiospores of *P. baumii* were invariably and significantly smaller than those of *P. linteus*, and observed microscopic features were mostly consistent with previous studies (Dai, 1999; Dai and Xu, 1998; Núñez and Ryvarden, 2000; Parmasto and Parmasto, 2001).

However, TAA 104264 is the species classified as *P. lonicerinus* by Parmasto and Parmasto (2001). They emphasized that speciation of the *P. linteus* group from the Russian Far East and Middle Asia has resulted from allopatric disjunction and sympatric specialization to different hosts. *Phellinus lonicerinus* living on *Lonicera* is widely distributed in Middle Asia and has been treated as synonymous with *P. linteus* by Bondartseva, but with *P. baumii* by Lyubarski and Vasilyeva, Dai and Xu, Dai, and Núñez and Ryvarden (Parmasto and Parmasto, 2001). In this study, TAA 104264 (lane 12 in Fig. 1) behaved like the strains of *P. baumii* in the analysis pattern of PCR-RFLP, suggesting that *P. lonicerinus* can be conspecific with *P. baumii*.

Morphological features of *P. linteus*:

Basidiocarps perennial, sessile, dimidiate to elongate, 5 cm long, 3 cm thick at the base, woody hard; pileal surface dark grayish brown to dark gray, concentrically zonate, radially and concentrically deeply rimose; margin mostly acute; hymenophores dark reddish brown to fulvous, narrowly to indistinctly sterile along the margin; pores regular, circular, 6-8 per mm; tube layers not receding; context woody.

Hyphal system dimitic; generative hyphae simple-septate, hyaline to golden yellow, 2.2-3.4 μm wide; skeletal hyphae golden yellow to golden ferrugineous, thick-walled, up to 4 μm wide; hymenial setae frequent, dark brown in KOH, 21-30 x 7-12 μm; basidia clavate, 13-14.8 x 6-7 μm, with four sterigmata; basidiospores ovoid to subglobose, pale golden brown, slightly thick-walled up to 1.1 μm, 5.1-5.7 x 3.5-4.0 μm (SFC 990520-2 from Costa Rica) and 6.2-7.4 x 5.1-6.3 μm (SFC 990520-1 from Mexico).

This species has been noted on *Quercus* and *Cassia* in the southeastern U.S. and Mexico in North America (Gilbertson and Ryvarden, 1987). It has 6-8 pores per mm but this measurement slightly differs from the result of Parmasto and Parmasto (2001) who

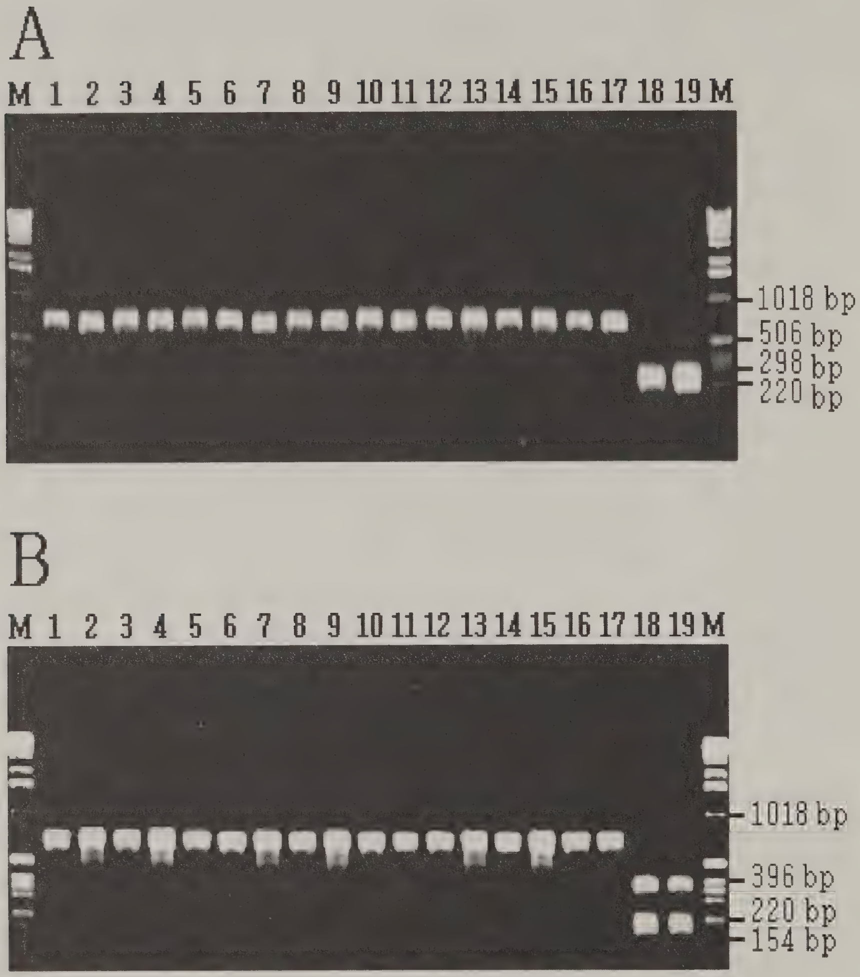
A
M 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 M
1018 bp
506 bp
298 bp
220 bp
B
M 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 M
1018 bp
396 bp
220 bp
154 bp

Fig. 1. *Dra*I (A) and *Hpa*II (B) digestion products of the amplified ITS rDNA region. The two outer lanes contain molecular weight markers (M). RFLP patterns of the ITS amplicons were obtained from sixteen strains of *Phellinus baumii* (lanes 1 to 11 and 13 to 17), one strain of *P. lonicerinus* (lane 12) and two strains of *P. linteus* (lanes 18 and 19). Lane 1, SFC 930719-15; lane 2, SFC 940818; lane 3, SFC 960406-4; lane 4, SFC 960708; lane 5, SFC 961121; lane 6, SFC 970218-01; lane 7, SFC 970605-01; lane 8, SFC 970611-08; lane 9, SFC 960405-04; lane 10, SFC 990322; lane 11, SFC 990508; lane 12, TAA 104264; lane 13, SFC 000111-10; lane 14, SFC 001106-1; lane 15, SFC 001106-2; lane 16, SFC 001106-4; lane 17, SFC 001106-7; lane 18, SFC 990520-1; lane 19, SFC 990520-2.

reported that the mean number of pores per mm of *P. linteus* was 7 to 8.3. The ovoid to subglobose spores, thick-walled spore wall and subtropical to tropical distribution are distinctive characters of *P. linteus*. In comparison with *P. baumii*, the walls of the basidiospores looked almost double in thickness and are a remarkable feature for this taxon as Gilbertson and Ryvarden (1987) indicated. However, there were some variations between *P. linteus* specimens from Mexico and Costa Rica. Spores and basidia from the Mexican specimen were much larger than those from the Costa Rican specimen. The swelling of tramal skeletals in *P. linteus* was observed to some extent but was not as much significant as emphasized by Dai and Xu (1998), and it is too subtle to use the swelling feature of tramal skeletals as a character to distinguish between *P. baumii* and *P. linteus*.

Although *P. baumii* of temperate regions and *P. linteus* of subtropical to tropical origin share many common characters, their samples were divided into two groups corresponding to two species according to morphological features, geographical distributions (Table 1) and also to PCR-RFLP patterns (Fig. 1). However, as far as the pore numbers of *P. baumii* and the spore sizes of *P. linteus* are concerned, there seems to be a possibility that certain intermediate or transitional types may exist between those two species, which requires more intensive studies in the light of phylogeographic distribution.

RFLP analyses of ITS region:

The primers ITS1 and LW1 amplified only one band (approximately 750 bp in length) from extracted DNA. In order to differentiate the two species, RFLPs of the ITS region were generated by restriction digestion with seven enzymes. Among them, *Cfo*I generated too many small fragments per digestion and *Apa*I, *Bam*HI, *Pst*I and *Rsa*I did not cut any amplicons. However, *Hpa*II (four-base cutting restriction enzyme) and *Dra*I (six-base cutting restriction enzyme) allowed a clear discrimination of two *Phellinus* species because they generated no fragments in amplicons of lanes 1 to 11 and 13 to 17 for *P. baumii* and lane 12 for *P. lonicerinus* but three fragments only in amplicons of lanes 18 and 19 for *P. linteus* (Fig. 1). The *Dra*I digestion on two strains of *P. linteus* generated three fragments of ca 250 bp that were all similar in size. The *Hpa*II-generated fragments for those of *P. linteus* were ca 170 bp, 230bp, and 380 bp in size, respectively.

Although *P. baumii* and *P. linteus* can be segregated on the basis of several morphological characters and geographical distribution boundaries, the former does not show much difference from the latter in certain cases, which makes it difficult to tell one apart from the other. However, such morphological weakness was compensated in this study by a molecular approach using PCR-RFLP analysis. Recently, the PCR-RFLP method has been used to study intraspecific variation in *Armillaria ostoyae* (Schulze *et al.*, 1997), to identify ectomycorrhizal fungi to the genera and species level (Erland *et al.*, 1994; Gardes and Bruns, 1996; Sanders *et al.*, 1995), to detect and identify decay fungi (Adair *et al.*, 2002; Jasalavich *et al*, 2000), and to identify intersterility groups of

Heterobasidion annosum (Garbelotto *et al*., 1996). Fischer (1996) used this method in the *Phellinus pini* group together with microscopic studies but found no apparent correlation between restriction-fragment data, geographic origin, and host of taxa.

However, PCR-RFLP patterns produced by the *Dra*I and *Hpa*II in this analysis clearly and visibly discriminated two look-alike related species of different geographical origins. In the case of temperate *P. baumii* and tropical to subtropical *P. linteus*, PCR-RFLP of the ITS region proved to be quite suitable for typing of the two species. This molecular method supported recent findings that the Asian fungus was in reality *P. baumii* rather than *P. linteus* (Dai, 1999; Dai and Xu, 1998; Núñez and Ryvarden, 2000; Parmasto and Parmasto, 2001).

In addition to several tangible morphological features and different geographical distributions, the authors found a new PCR-RFLP character using *Dra*I and *Hpa*II that can unequivocally differentiate *P. baumii* from *P. linteus*. Therefore, for sibling or puzzling fungi, such as *P. baumii* and its related taxa, where traditional taxonomy experiences difficulty, molecular typing can be easily applied for final confirmation. As in this study, it is expected that the molecular approach based on PCR-RFLP analysis can be ideally utilized as a rapid and efficient technique for the identification, verification, and delimitation of medicinally, commercially, or industrially important fungi.

ACKNOWLEDGMENTS

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MICROFUNGI FROM VENEZUELA. A NEW SPECIES OF BRACHYDESMIELLA, A NEW COMBINATION, AND NEW RECORDS

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ABSTRACT

Brachydesmiella eugecapiellana anam. sp. nov., found on decaying fallen leaves of *Nectandra* sp. in a cloud forest from Venezuela, is described and illustrated. This is characterized by navicular, ampulliform to narrow fusiform, rostrate, 2-3-septate, verruculose, very pale brown conidia. *Selenodriella ponmudiensis* comb. nov. is proposed. Some microfungi are recorded from cloud forests in Venezuela.

Key words: *Selenodriella,* hyphomycetes, leaf litter, systematics, tropical fungi.

INTRODUCTION

The genus *Brachydesmiella* G. Arnaud ex S. Hughes (1961), is characterized by differentiated, mononematous, brown to pale brown conidiophores and tretic, multilocal, sympodial, indeterminate, terminal and intercalary conidiogenous cells. The conidial secession is schizolytic. Five species of *Brachydesmiella* have been published in the literature, *B. biseptata* G. Arnaud ex S. Hughes (1961) (the type species); *B. caudata* V. G. Rao & de Hoog (1986); *B. anthostomelloidea* Goh & K. D. Hyde (1996), *B. orientalis* (V. G. Rao & de Hoog) Goh, in Sivichai *et al.* (1998) and *B. verrucosa* Goh, Sivichai, K. D. Hyde & Hywel-Jones (1998).

The conidium ontogeny in *Brachydesmiella* have been considered as tretic according with Ellis (1971), Rao and de Hoog (1986) and Goh and Hyde (1996), in fact very small pores at the outer wall can be observed under bright field and phase contrast microscope, however Sivichai *et al.*, (1998) have described the conidiogenous cells as polyblastic and further study on conidial ontogeny would be necessary.

During a mycological survey of saprobes conidial fungi from tropical leaf litter in several undisturbed rainforest in Venezuela, numerous microfungi were collected. Among them was a collection of a fungus belonging to the genus *Brachydesmiella* G. Arnaud ex S. Hughes (1961), it is described as *Brachydesmiella eugecapiellana* anam. sp. nov.

MATERIALS AND METHODS

Leaf litter samples were placed in separate paper bags and taken to the laboratory. The microfungi were isolated from single conidia or ascospore picked out under a stereomicroscope immediately after they were collected from the substrate. They were grown on corn meal agar mixed 1:1 with carrot extract, incubated at 25 °C under alternating cycles of 12 hours of daylight and darkness. Other samples were incubated in Petri dish moist chambers at 25 °C and examined at regular intervals for the presence of microfungi. Mounts were prepared in DL-lactic acid (85 %) and polyvinyl alcohol-glycerol (8.0 g in 100 ml of water, plus 5 ml of glycerol) and measurements made at 1000 x magnification.

TAXONOMIC PART

Brachydesmiella eugecapiellana R. F. Castañeda, Iturriaga et Saikawa anam. sp. nov.

Fig. 1

Etymol. L. *eugecapiellana* – dedicated to Dr. Eugenio Capiello (Venezuela).

Ad fungus conidiales, hyphomycetes pertinens. ***Coloniae*** *in substrato naturali pilosae, caespitosae, effusae, amphigenae, aureae vel fulvae. Mycelium plerumque in substrato immersum, ex hyphis septatis, ramosis, laevibus, pallide brunneis, 1-3 µm diam., compositum.* ***Conidiophora*** *conspicua, mononematosa, erecta, sinuata vel leviter geniculatae, 4-6(-8)-septata, non-ramosa, usque ad 70 µm alta, 6-8 µm crassa ad basim, dilute brunnea vel fulva, levia.* ***Cellulae conidiogenae*** *treticae, multilocales, terminales et intercalares, sympodiales, indeterminatae, 9-16 x 4-5 µm, dilute brunneae vel fulvae, in conidiophoris incorporatae. Loci conidiogeni numerosi, pori, 0.5- 1 µm diam, interdum leviter obcuri circa pori. Secedentia conidiorum schizolytica.* ***Conidia*** *solitaria, navicularia, ampulliformia vel angusta fusiformia, rostrata, cicatricata ad basim, 2-3-septata, verruculosa, dilute brunnea, acropleurogena, sicca, 32-40 x 4.0-6.5 µm, 0.8-1.2 µm crassa ad apicem. Teleomorphosis ignota.*

Matrix: C00/77, *in foliis dejectis putridis Nectandrae sp., in sylvi nebulosi,* "Colonia Tovar", Estado Miranda, Venezuela, legit Eugenio Capiello, 25. XI. 2000

Holotypus: MUCL 43326.

Conidial fungi, hyphomycetes. **Colonies** on the natural substratum hairy to caespitose, effuse, amphigenous, yellow to tawny. Mycelium mostly immersed.

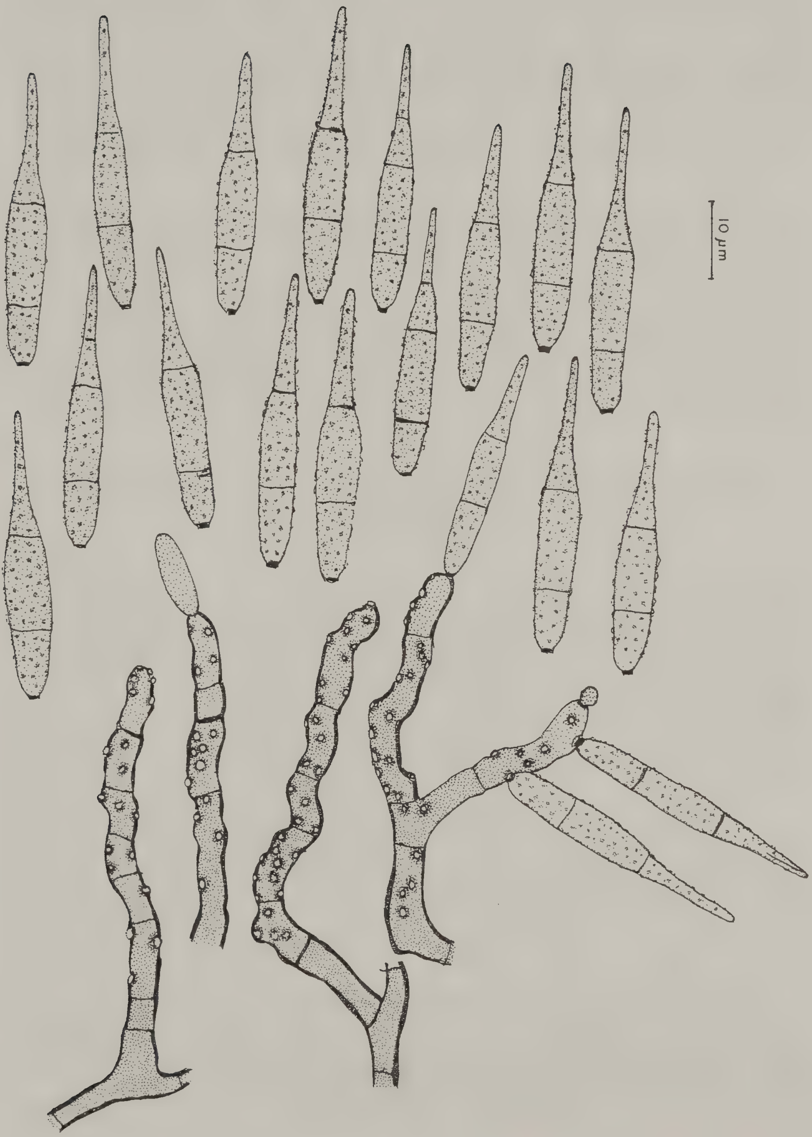

Fig. 1. *Brachydesmiella eugecapiellana* (MUCL 43326).

Hyphae septate, branched, pale brown, smooth-walled, 1-3 µm diam. **Conidiophores** differentiated, mononematous, erect, sinuate to slightly geniculate, 4-6(-8)-septate, simple, up to 70 µm tall, 6-8 µm wide at the base, pale brown to tawny, smooth. **Conidiogenous cells** tretic, multilocal, terminal and intercalary, sympodial, indeterminate, cicatrized, 9-16 x 4-5 µm, pale brown to tawny, integrated; conidiogenous loci pores, numerous, 0.5- 1 µm diam, slightly melanized near pores. Conidial secession schizolytic. **Conidia** solitary, navicular to narrow fusiform, rostrate, cicatrized at the base, 2-3-septate, verruculose, pale brown, acropleurogenous, solitary, dry, 32-40 x 4.0-6.5 µm, 0.8-1.2 µm wide at the apex. Teleomorph: unknown.

Matrix: C00/77, on fallen decaying leaves of *Nectandra* sp., in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000.
Holotype: MUCL 43326.

Brachydesmiella eugecapiellana resembles *B. verrucosa* in conidial ornamentation and number of septa, but *B. verrucosa* has 56-92 x 12-17 µm, unequally pigmented conidia with central cell pale olivaceous brown, darker than the apical and basal cells. Also, the apical rostrate cell of *B. verrucosa* is 4-6 µm wide.

OTHER MICROFUNGI RECORDED FROM CLOUD FORESTS IN VENEZUELA

Acrogenospora sphaerocephala (Berk. & Br.) M. B. Ellis, *Dematiaceous Hyphomycetes*, Kew, p. 114 (1971).

Specimen examined: C97/158 on rotten leaves of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Acumispora phragmospora Matsush., *Matsushima Mycological Memoirs* **1:** 3 (1980).

Specimen examined: C98/17-9, on rotten leaves of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Anungitea continua Matsush., *Icones Microfungorum a Matsushima Lectorum*, Kobe, p. 7 (1975)

Specimen examined: C00/72-2, on submerged rotten leaves of unidentified *Poaceae* in stream, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Ardhachandra cristaspora (Matsush.) Subram. & Sudha, *Can. J. Bot.* **56:**731 (1979).

Specimen examined: C97/161, on rotten fallen leaf of *Theobroma cacao*, Campo Centro, Estación Experimental Miranda, Caucagua, Estado Miranda, coll. Isidro Contreras, 27-X-1997.

Ardhachandra selenoides (de Hoog) Subram. & Sudha, *Can. J. Bot.* **56:**731 (1979).

Specimen examined: USB C00/73-3, on rotten leaves of unidentified plant, in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000.

Arthrobotrys haptospora (Drechsler) Schenck, W. B. Kendr. & Pramer, *Can. J. Bot.* **55:** 983 (1977).

Specimen examined: USB C00/146-1, on dead of unidentified nematode, in leaf of *Gyranthera caribensis*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Culture deposited:** USB C00/146-1.

Arthrobotrys musiformis Drechsler, *Mycologia* **29:** 481 (1937).

Specimen examined: USB C00/60-4, On rotten seed of *Wettinia praemosa*. In tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Culture deposited:** USB C00/60-4.

Beltrania rhombica O. Penzing, *Nuovo G. Bot. Ital.* **14:** 72 (1882).

Specimens examined: USB C97/156-6, on decaying fallen leaves of *Gyranthera caribensis*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. USB C00/64, on rotten leaf of unidentified plant, in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000. **Cultures deposited:** CBS 109466 = USB C00/64

Beltraniella pirozynskii P. M. Kirk, *Trans. Br. Mycol. Soc.* **77:** 457 (1984).

Specimen examined: USB C97/153, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Beltraniopsis esenbeckiae Batista & Becerra, *Publções Inst. Micol. Recife*, **296:** 1-13 (1960).

Specimen examined: USB C97/ 168, fallen rotten leaves of *Eucalyptus* sp., Instituto de Estudios Avanzados (IDEA), Tecnopolis, Sartanejas, Baruta, Estado Miranda, Venezuela, 1100m altitude, coll. R. F. Castañeda, 20.XI. 1997.

Beltraniopsis tanzaniensis Pirozynski, *Mycol. Pap.* **129:** 40 (1972).
Specimen examined: USB C97/169, on fallen rotten leaf of unidentified plant,, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Brachysporiella arengae (Matsush.) Hol-Jech. *Ceska Mykologie* **37:** 14 (1983).
Specimen examined: USB C00/76-5, on rachis of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109452 = USB C00/60-2.

Camposporium antennatum Harkn., *Bull. Calif. Acad. Sci.* **1:** 37-38 (1884).
Specimens examined: USB C97/159, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. C00/71, on submerged stem of unidentified *Poaceae*, in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000. **Cultures deposited:** CBS 101169 = USB C98/4, CBS 109473 = USB C00/71.

Campylospora filicladia Nawawi, *Trans. Br. Mycol. Soc.* **63:** 603 (1974).
Specimen examined: USB C97/186-1, on submerged fallen rotten leaves of *Gyranthera caribensis*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Ceratocystis sp.
Specimen examined: USB C00/60-2, On synnemata of *Graphium penicillioides*, in rotten seed of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109452 = USB C00/60-2.

Ceratosporium productum Petch, *Ann. R. Bot. Gdns Peradeniya* **3:** 9 (1906).
Specimen examined: USB C00/94, on rachis of decomposed leaf of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.
Note: A *Selenosporella*-like synanamorph on the same hyphae was observed.

Cercosperma arnaudii B. Sutton & Hodges, *Nova Hedwigia* **35:** 800 (1981).
Specimen examined: USB C97/180-1, on fallen rotten leaves of *Eucalyptus* sp., Instituto de Estudios Avanzados (IDEA), Tecnopolis, Sartanejas, Baruta, Estado Miranda, Venezuela, 1100 m altitude, coll. R. F. Castañeda, 20.XI. 1997. **Culture deposited:** USB C97/180-1.

Chaetendophragmia triangularia Matsush., *Microfungi of the Solomon Islands and Papua-New Guinea*, Kobe, p. 12 (1971).

Specimen examined: USB C00/80, on fallen rotten leaves of *Miconia* sp., in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Chaetomium longicolleum, Krzemieniewska & Badura, *Acta Societatis Botanicorum, Poloniae* **23:** 748 (1954)

Specimen examined: USB C98/35, on fallen rotten leaf of unidentified plant,, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Culture deposited:** CBS 100950.

Chaetopsina fulva Rambelli, *Atti Accad. Sci. Ist. Bologna Rc. Ser.* 11, **3:** 5(1956).

Specimen examined: USB C00/96, on fallen decaying leaves of *Nectandra* sp., in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello,
25. XI. 2000. **Culture deposited:** USB C00/96.

Chloridium codinaeoides Pirozynski, *Mycol. Pap.* **129:** 8 (1972).

Specimen examined: USB C00/86-5, on rachis of decomposed leaf of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Cladosporium cubense R. F. Castañeda, *Fungi Cubenses* II. Inst. Inves. Fund. Agric. Trop., Habana, p.4 (1987).

Specimen examined: USB C97/165, on fallen rotten leaf, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. **Culture deposited:** USB C97/165.

Clonostachys compactiuscula (Sacc.) D. Hawksworth & W. Gams in Hawksworth and Punithalingam, *Trans. Br. Mycol. Soc.* **64:** 90 (1975).

Specimen examined: USB C98/2, on wood, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. **Culture deposited:** CBS 101113 = USB C98/2.

Cryptophiale kakombensis Pirozynski, *Can. J. Bot.* **46:** 1124 (1968).

Specimen examined: USB C00/77-4, on fallen decaying leaves of *Nectandra* sp., in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000. **Culture deposited:** USB C00/77-4

Cryptophiale udagawae Pirozynski & Ichinoe in Pirozynski, *Can. J. Bot.* **46:** 1123 (1968).

Specimen examined: USB C98/33, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Culture deposited:** CBS 100968.

Cylindrocladium clavatum Hodges & May, *Phytopathology* **62:** 898 (1972).

Specimens examined: USB C00/85-1, on fallen decaying leaves of *Miconia* sp., in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000. USB C00/73, on fallen decaying leaves of *Miconia* sp., in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000. **Culture deposited:** CBS 109445 = USB C00/85-1, CBS 109448 = USB C00/73.

Dactylaria candidula (Höhnel) Schenck, Bahtt & W. B. Kendr., *Can. J. Bot.* **46:** 1258 (1968).

Specimen examined: USB C00/76-2, on rachis of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Culture deposited:** USB C00/76-2.

Dactylaria fusiformis Shear & Crane, *Mycologia* **63:** 243 (1971).

Specimens examined: USB C97/156 on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. USB C00/61-3A, on submerged rotten leaf in stream, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Culture deposited:** CBS 109485 = USB C00/62-2, CBS 109484 =USB C00/61- 3A.

Dactylaria irregularis de Hoog, *Stud. Mycol.* **26:** 32 (1985).

Specimen examined: USB C97/152, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Dactylaria lepida Minter *Trans. Br. Mycol. Soc. 74:* 570 (1980).

Specimen examined: USB C00/63-1, on submerged leaf of *Miconia* sp., in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000. **Cultures deposited:** CBS 109483 = USB C00/63-1.

Dactylaria obtriangularia Matsush., *Icones Microfungorum a Matsushima Lectorum*, Kobe, p. 51 (1975)

Specimen examined: USB C00/73-2, on rotten leaves of unidentified plant, in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000.

Dactylaria sparsa R. F. Castañeda & W. B. Kendr., *University of Waterloo Biology Series*, **35:** 33 (1991).

Specimen examined: USB C00/60-1, on synnemata of *Graphium penicillioides*, in rotten seed of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109465 = USB C00/60-1.

Dactylaria zapatensis R. F. Castañeda, *Fungi Cubenses* III. Inst. Inves. Fund. Agric. Trop., Habana, p. 5 (1988).

Specimen examined: USB C98/24, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Culture deposited:** CBS 101122

Dendrosporium lobatum Plakidas& Edgerton : Crane *Trans. Br. Mycol. Soc.* **58:** 423 (1972).

Specimen examined: USB C00/62-2, on submerged rotten leaf of *Miconia* sp. in stream, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109442 = USB C00/62-2.

Dendryphiella vinosa (Berk. & Curtis) Reisinger, *Bull. Soc. Mycol. Fr.* **84:** 27 (1968).

Specimen examined: USB C00/70, on submerged rotten leaf of unidentified plant, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109467 = USB C00/70.

Dictyosporium micronesicum Matsush. *Matsushima Mycological Memoirs* **2:** 8 (1981).

Specimen examined: USB C97/184, on fallen rotten leaf of *Theobroma cacao*, Campo Centro, Estación Experimental Miranda, Caucagua, Estado Miranda, coll. Isidro Contreras, 27-X-1997.

Endophragmiella cesatii (Mont.) S. Hughes, *N. Z. Jl. Bot.* **17:** 148 (1979).

Specimen examined: USB C97/173, on rachis of *Bactris setulosa*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Note: A *Selenosporella*-like synanamorph at the conidial apex was observed.

Endophagmiella naromoruensis P. M. Kirk, *Mycotaxon* **23:** 323 (1985).

Specimen examined: USB C97/179, on *Hypoxylon* sp. in wood,, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry

Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Endophragmiella uniseptata, (M. B. Ellis) S. Hughes, *N. Z. Jl. Bot.* **17:** 156 (1979).

Specimen examined: USB C98/44-1, on rachis of *Bactris setulosa*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Cultures deposited:** CBS 101129 = USB C98/44-1.

Gliocephalotrichum sp.

Specimen examined: USB C00/62, on submerged leaf of *Miconia* sp., in a cloud forest, "Colonia Tovar", Estado Miranda, Venezuela, coll. Eugenio Capiello, 25. XI. 2000. **Cultures deposited:** CBS 109446 = USB C00/62.

Graphium penicillioides Corda, *Icon. Fung.* **1:** 18 (1837).

Specimen examined: USB C00/60, on rotten seed of *Wettinia praemosa*. In tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109450 = USB C00/60.

Gyrothrix circinata (Berk. & Curt.) S. Hughes, *Can. J. Bot.* **36:** 771 (1958).

Specimen examined: USB C97/156-5, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Gyrothrix verticiclada (Goid.) Hughes & Pirozynski, *N. Z. Jl. Bot.* **9:** 39-45 (1971)

Specimen examined: USB C97/159-3, on fallen rotten leaves of *Gyranthera caribensis*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Culture deposited:** USB C97/159-3.

Helicomyces colligatus R.T. Moore, *Mycologia* **46:** 89-92 (1954).

Specimen examined: USB C97/145-2, on fallen rotten leaves of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Culture deposited:** USB C97/159-3.

Helminthosporium palmigenum Matsush., *Microfungi of the Solomon Islands and Papua-New Guinea*, Kobe, p. 30 (1971).

Specimens examined: USB C97/145-1, on rachis of *Bactris setulosa*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. USB C00/90, on rachis of decomposed leaf of *Wettinia praemosa*. In a tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Culture deposited:** USB C00/90.

Helminthosporium velutinum Link, *Magazin Ges. Naturf. Freunde*, Berlin, **3:** 10 (1809)

Specimen examined: USB C00/86, on petiole of decomposed leaf of *Wettinia praemosa*. In tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Culture deposited:** USB C00/90.

Henicospora coronata B. Sutton & P. M. Kirk, *Trans. Br. Mycol. Soc.* **75:** 249 (1980).

Syn. *Trichocladium elegans* R. F. Castañeda & G. Arnold, 1985 *Rev. Jard. Bot. Nac.* **6:** 52 (1985).

Specimen examined: USB C00/89-2, on fallen rotten leaf of *Chrysophyllum* sp., in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Idriella cubensis R. F. Castañeda & Arnold, *Rev. Jard. Bot. Nac.* **6:** 50 (1985).

Specimen examined: USB C97/163, on fallen rotten leaf of *Theobroma cacao*, Campo Centro, Estación Experimental Miranda, Caucagua, Estado Miranda, coll. Isidro Contreras, 27-X-1997. **Culture deposited:** USB C97/163

Isthmolongispora minima Matsush., *Microfungi of the Solomon Islands and Papua-New Guinea*, Kobe, p. 30 (1971).

Specimen examined: USB C97/170-1, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Isthmolongispora variabilis Matsush. *Icones Microfungorum a Matsushima Lectorum*, Kobe, p. 90 (1975).

Specimen examined: USB C00/89-3A, on submerged rotten leaf of *Chrysophylllum* sp., in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Isthmotricladia laeensis Matsush., in Kobayasi *et al.*, *Bulletin of the National Science Museum* Tokyo **14:** 480 (1971).

Specimen examined: USB C00/63, on submerged rotten leaf in stream, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109485 = USB C00/63.

Ityorhoptrum verruculosum (M. B. Ellis) P. M. Kirk, *Trans. Br. Mycol. Soc.* **86:** 417 (1986)

Specimens examined: USB C97/174-2, on rachis of *Bactris setulosa*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. USB C00/83-2, on rachis of decomposed leaf of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Kionochaeta ramifera (Matsushima) P. M. Kirk & B. Sutton, *Trans. Br. Mycol. Soc.* **85:** 715 (1985).

Specimen examined: USB C00/72, on rotten leaf of unidentified plant, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Lunulospora sp.

Specimen examined: USB C00/60-3, on synnemata of *Graphium penicillioides*, in rotten seed of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Minimelanolocus leptotrichus (Cooke & Ellis) R. F. Castañeda & Heredia in R. F. Castañeda *et al. Cryptogamie Mycol.* **22:** 10 (2001).

Syn.: *Pseudospiropes leptotrichus* (Cooke & Ellis) M. B. Ellis, *More Dematiaceous Hyphomycetes*, Kew, p. 224 (1976).

Specimen examined: USB C00/60-6, on rotten seed of *Wettinia praemosa*. In tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Mycoleptodiscus terrestris (Gerdemann) Ostaz., *Mycologia* **59:** 970 (1968).

Specimens examined: USB C97/142, on fallen rotten leaves of *Gyranthera caribensis*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. USB C97/156-2, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Nakataea fusispora Matsush., *Icones Microfungorum a Matsushima Lectorum*, Kobe, p. 100 (1975)

Specimens examined: USB C97/151 on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. USB C97/186 on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho

Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. USB C00/76, on rachis of decomposed leaf of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** USB C97/151, USB C00/76.

Nectria consors (Ellis & Everhart) Seaver, *Mycologia* **1:** 61 (1909).

Specimen examined: USB C98/3 on fallen rotten pod of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela, 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Cultures deposited:** CBS 101114.

Parasympodiella laxa (Subram. & Vittal) Ponnappa, *Trans. Br. Mycol. Soc.* **64:** 344 (1975).

Specimen examined: USB C97/139, on fallen rotten leaves of *Eucalyptus* sp., Instituto de Estudios Avanzados (IDEA), Tecnopolis, Sartanejas, Baruta, Estado Miranda, Venezuela, 1100 m altitude, coll. R. F. Castañeda, 20.XI. 1997.

Phaeoisaria clematidis (Fuckel) S. Hughes, *Can. J. Bot.* **36:** 795 (1958).

Specimen examined: USB C00/86-2, on rachis of decomposed leaf of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Phaeoisaria infrafertilis B. Sutton & & Hodges, *Nova Hedwigia* **27:** 219 (1976)

Synonym: *Chryseidea africana* Onofri, in Onofri, Lunghini, Rambelli & Lustrati, *Mycotaxon* 13: 333 (1981).

Specimens examined: USB C00/65-1, on submerged rotten leaf of *Miconia* sp., in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. USB C00/79, on rotten leaf of unidentified plant, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109469 = USB C00/65-1, CBS 109468 = USB C00/79.

Phialocephala foliicola P. M. Kirk, *Mycotaxon* **23:** 337 (1985).

Specimen examined: USB C00/79-1, on rotten leaf of unidentified plant, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Phialocephala humicola Jong & Davis, *Mycologia* **64:** 1352 (1972).

Specimen examined: USB C00/69, on rotten leaf of unidentified *Poaceae*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Pleurothecium recurvatum Höhnel, *Zentbl. Bakt. Parasitkde Abt.* 2, **60:** 26 (1923).

Specimen examined: USB C00/94-2, on rachis of decomposed leaf of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Pseudodictyosporium wauense Matsush., *Microfungi of the Solomon Islands and Papua-New Guinea*, Kobe, p. 33 (1971).

Specimen examined: USB C97/182, on twig, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. **Cultures deposited:** USB C97/182.

Pleurotheciopsis bramleyi B. Sutton, *Trans. Br. Mycol. Soc.* **61:** 420 (1973).

Specimen examined: USB C00/87, on twig, in tropical cloud forest " Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Repetophragma dennisii (M. B. Ellis) Subram., *Proc. Indian natn. Sci. Acad.* **58:** 185 (1992).

Specimen examined: USB C99/119, on twig, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Rhexoacrodictys queenslandica (Matsush.) W. A. Baker & Morgan-Jones, (in Baker, Partridge and Morgan-Jones) *Mycotaxon* **82:** 110 (2002).

Specimen examined: C97/144-2 and C00/145, on rachis of *Bactris setulosa*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Satchmopsis brasiliensis B. Sutton & Hodges, *Nova Hedwigia* **26:** 1-16 (1975).

Specimen examined: USB C97/136, on fallen rotten leaves of *Eucalyptus* sp., Instituto de Estudios Avanzados (IDEA), Tecnopolis, Sartanejas, Baruta, Estado Miranda, Venezuela, 1100 m altitude, coll. R. F. Castañeda, 20.XI. 1997. **Culture deposited:** USB C97/180-1.

Scolecobasidium dendroides Pirozynski & Hodges, *Can. J. Bot.* **51:** 162 (1973).

Specimens examined: USB C97/172, on setae and conidiophores of *Beltraniella portoricensis* on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. Specimen examined: USB C97/176-2, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho

Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Selenodriella ponmudiensis (Varghese & V. G. Rao) R. F. Castañeda and Saikawa *comb. nov.*

Basionym: *Circinotrichum ponmudiense* Varghese & V. G. Rao, in *Botaniska Notiser* **131:**215 (1978).

Specimen examined: USB C00/76-3, on rachis of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109454 = USB C00/76-3.

Note: *Circinotrichum ponmudiense* has conspicuous, mononematous, setiforme conidiophores and hologenous, multilocal, lageniform, sympodial conidiogenous cells, borne laterally and sometimes terminally on the conidiophores; all these characters are clearly defined in the genus *Selenodriella* R. F. Castañeda & Kendrick (1990).

Selenosporella acicularis B. Sutton & Hodges *Nova Hedwigia* **28:** 490 (1976).

Specimens examined: USB C97/160-2, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. USB C00/166, on fallen rotten leaves of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Selenosporella curvispora MacGarvie, *Scient. Proc. R. Dubl. Soc., Ser. B* **2:**153-158 (1968).

Specimen examined: USB C00/94-3, on rachis of decomposed leaf of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Septomyrothecium uniseptatum Matsush., *Bull. Nat. Sci. Mus. Tokyo* **14:** 470 (1971).

Specimens examined: USB C97/162, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. USB C98/23-1, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. **Culture deposited:** CBS 101166 = USB C98/23-1

Septomyrothecium sp.

Specimens examined: USB C97/142-2, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. USB C00/149, on fallen rotten leaves of *Gyranthera caribensis*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Note: The conidia has an apical mucous, 12-16 x 0.5-1.0 µm, hyaline appendage.

Solosympodiella clavata Matsush., *Microfungi of the Solomon Islands and Papua-New Guinea*, Kobe, p. 49 (1971).

Specimen examined: USB C00/89-1, on submerged rotten leaf of *Chrysophyllum* sp., in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Sopagraha elegans R. F. Castañeda *Deuteromycotina de Cuba. Hyphomycetes* 2. *Inst. Inves. Fund. Agric. Trop.* 13 (1985).

Specimen examined: USB C00/92, on submerged rotten leaf of unidentified plant, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109477 = USB C00/70-2.

Sporidesmiella hyalosperma (Corda) P. M. Kirk, *Trans. Br. Mycol. Soc.* **79:** 481 (1982).

Specimen examined: USB C97/175, on dead stem of unidentified *Poaceae*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Sporidesmiella hyalosperma (Corda) P. M. Kirk var. *nova-zelandiae* (S. Hughes) P. M. Kirk, *Trans. Br. Mycol. Soc.* **79:** 484 (1982).

Specimen examined: USB C00/83-2, on rachis of decomposed leaf of *Wettinia praemosa*, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Sporidesmium minigelatinosum Matsush., *Microfungi of the Solomon Islands and Papua-New Guinea*, Kobe, p. 58-59 (1971).

Specimen examined: USB C97/164-2, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Sporidesmium polymorphum R. F. Castañeda, *Deuteromycotina de Cuba. Hyphomycetes IV*. Inst. Inves. Fund. Agric. Trop. Habana, p. 11 (1986).

Specimen examined: USB C97/164-3, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Sporoschisma saccardoi Mason & S. Hughes, *Mycol. Pap.* **31:** 20 (1949).

Specimens examined: USB C97/154, on rachis of *Bactris setulosa*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997. USB C00/83, on rachis of decomposed leaf of *Wettinia praemosa.* In tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Sporsochisma nigroseptata D. Rao & R. Rao, *Mycopath. Mycol. Appl.* **24:** 82 (1964).

Specimen examined: USB C97/174-1, on rachis of *Bactris setulosa*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal. 25. XI. 1997.

Stachybotrys atra Corda, *Icon. Fung.* **1:** 21 (1837).

Specimen examined: USB C00/70-2, on submerged rotten leaf of unidentified plant, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000. **Cultures deposited:** CBS 109477 = USB C00/70-2.

Stachybotrys atra Corda var. *microspora* Mathur & Sankala, *Sci. Cult.,* **32:** 93 (1966).

Specimens examined: USB C97/161-4 on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Stachylidium bicolor Link : S. F. Gray; Link in *Magazin Ges. Naturf. Freude Berl.* **3:** 15 (1809); S. F. Gray, *Nat. Arr. Br. Pl.* : 553 (1821); Fries, *Syst. Mycol.* **3:** 391 (1832).

Specimens examined: USB C97/181 on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Subramaniomyces fusisaprophyticus (Matsush.) P. M. Kirk, *Trans. Br. Mycol. Soc.* **78:** 71 (1982).

Specimen examined: USB C00/91, on submerged rotten leaf of *Chrysophyllum* sp., in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Subulispora britannica B. Sutton, *Trans. Br. Mycol. Soc.* **61:** 423 (1973).

Specimen examined: USB C00/79-1, on rotten leaf of unidentified plant, in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Thozetella cristata Pyrozynski et Hodges, *Can. J. Bot.* **51:** 168 (1973).

Specimens examined: USB C98/1-1 on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. **Culture deposited:** CBS 101112

Trichothecium microvermisporum R. F. Castañeda, *Fungi Cubenses* 2. *Inst. Inves. Fund. Agric. Trop.* 11 (1987).

Specimen examined: USB C00/89-3A, on submerged rotten leaf of *Chrysophyllum* sp., in tropical cloud forest "Colonia Tovar" Estado Miranda, Venezuela, coll. R. F. Castañeda and T. Iturriaga, 25. XI. 2000.

Wiesneriomyces laurinus (Tassi) P. M. Kirk, *Trans. Br. Mycol. Soc.* **82:** 748 (1984).

Specimens examined: USB C98/1-2, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. USB C97/156-4, on fallen rotten leaf of *Gyranthera carabensis*, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997. USB C97/183, on rotten fallen leaf of *Theobroma cacao*, Campo Centro, Estación Experimental Miranda, Caucagua, Estado Miranda, coll. Isidro Contreras, 27-X-1997. **Culture deposited:** CBS 101143 = USB C98/1-2.

Zelosatchmopsis sacciformis (R. F. Castañeda) Nag Raj & R. F. Castañeda, *Can. J. Bot.* **69:** 633 (1991).

Specimen examined: USB C97/185-1, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

Zygosporium germinatum S. Hughes, *Mycol. Pap.* **36:** 825 (1951).

Specimen examined: USB C97/163-1, on fallen rotten leaf of unidentified plant, in a cloud forest, "Andy Fields", Estación Biológica Rancho Grande, Parque Nacional "Henry Pittier", Estado Aragua, Venezuela. 1200 m altitude, coll. R. F. Castañeda, T. Iturriaga and G. Vidal, 25. XI. 1997.

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Goh, T. K. and Hyde, K. D. 1996. *Brachydesmiella anthostomelloidea*, a new species of dematiaceous hyphomycete from Australia. Mycological Research 100: 1364-1366.

Hughes, S. J. 1961. Microfungi. VII. *Brachydesmiella* Arnaud. *Canadian Journal of Botany* **39:** 1095-1097.

Rao, V. G. & de Hoog, G. S. 1986. New or critical hyphomycetes from India. *Studies in Mycology*. **28:** 1-84.

Sivichai, S., Goh, T. K., Hyde, K. D. and Hywel-Jones, N. L. 1998. The genus *Brachydesmiella* from submerged wood in the tropics, including a new species and new combination. *Mycoscience* **39:** 239-247.

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A NEW SPECIES OF MINIMELANOLOCUS AND SOME HYPHOMYCETE RECORDS FROM RAIN FORESTS IN BRAZIL

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ABSTRACT

Minimelanolocus olivaceus anam. sp. nov., found on a decaying runner-like stem attached to a rotten leaf of unidentified species in a rainforest in Brazil, is described and illustrated. This new species is characterized by obclavate, 2-3(4)-septate, very pale olivaceous, smooth conidia. Notes on previously described species are given. Additional hyphomycetes are recorded for the first time from rainforests in Brazil.

Key words: Hyphomycetes, tropical fungi, *Sympodioplanus*.

INTRODUCTION

Numerous microfungi were collected during a mycological survey of saprobic conidial fungi from tropical leaf litter in several undisturbed rainforests in Brazil. Among the collections was a fungus belonging to the genus *Minimelanolocus* R. F. Castañeda & Heredia (in Castañeda *et al.,* 2001). The genus *Minimelanolocus* was established for species with hologenous, multilocal, integrated conidiogenous cells with sympodial proliferations and inconspicuous or slightly prominent, narrow, opaque, refractive to somewhat obscure conidiogenous loci. The conidia are euseptate, with obscure or refractive basal scar. The fungus from leaf litter in this study differs from described species of *Minimelanolocus* by conidial size, pigmentation and number of septa.

MATERIALS AND METHODS

Leaf litter samples were placed in separate paper bags and taken to the laboratory. The microfungi were isolated from single conidia picked out under a stereomicroscope immediately after they were collected from the substrate. They were grown on corn meal agar mixed 1:1 with carrot extract, incubated at 25 ° C under alternating cycles of 12 hours of daylight and darkness. Other samples were incubated in Petri dish moist chambers at 25 °C and examined at regular intervals for the presence of microfungi. Mounts were prepared in DL-lactic acid (85 %) and polyvinyl alcohol-glycerol (8.0 g in 100 ml of water, plus 5 ml of glycerol) and measurements made at 1000 x magnification.

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TAXONOMIC PART

Minimelanolocus olivaceus R. F. Castañeda et Guarro anam. sp. nov. Figs. 1, 2

Etymol. Latin, *olivaceus*, meaning olive-green.

Coloniae *in substrato naturali effusae, pilosae, olivaceae ad usque perviride. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, laevibus, dilute brunneis, 1.0-1.5 µm diam compositum.* ***Conidiophora*** *conspicua, mononemata, solitaria vel 2-4- aggregata, erecta, recta vel flexuosa, cylindrica, apice versus sinuosa ad usque geniculata, 5-9- septata, levia, brunnea, apice versus pallidiora, 55-120 x 5-8(-10) µm.* ***Cellulae conidiogenae*** *multiloculatae, hologenosae, indeterminatae, 9-20 x 3 µm, sympodialiter proliferantes, terminales vel intercalares mutantes, pallide brunneae vel subhyalinae, in conidiophoris incorporatae.* ***Loci conidiogeni*** *inconpicui vel leviter prominentibus, refractivi, 0.5 µm lati.* ***Secedentia conidiorum*** *schizolytica.* ***Conidia*** *obclavata usque ad cylindrica, rotundata ad apicem, attenuata et angusta truncata ad basim, solitaria, interdum cum secundaria conidia visa; 2-3(4)-euseptata, 13-25 x 2.5-3.0 µm, acropleurogena, sicca, levia, pallide olivacea, viridis in massa.*

Teleomorphosis ignota.

Habitat: *In caulis stoloniformis emuortis putridis in foliis putridis; in sylvae pluvialis*, Rio Tinto, Brazil, *legit* J. Guarro, 14. IX. 1997.

Holotypus: MUCL 40706.

Colonies on the natural substratum effuse, hairy, olive-green to deep green. Mycelium superficial and immersed, composed of septate, branched, smooth, pale brown, 1.0-1-5 µm diam hyphae. **Conidiophores** differentiated, mononematous, solitary or 2-4 aggregated, erect, straight or flexuous, cylindrical, sinuate or geniculate towards the apex, 5-9-septate, smooth, pale brown and paler towards the apex, 55-120 x 5-8(-10) µm. **Conidiogenous cells** multilocal, hologenous, integrated, 9-20 x 3 µm, indeterminate, sympodially proliferating, terminal, becoming intercalary, pale brown or subhyaline. **Conidiogenous loci** inconspicuous or slightly protuberant, refractive, 0.5 µm wide. **Conidial secession** schizolytic. **Conidia** obclavate to cylindrical, rounded at the apex, attenuate and narrowly truncate at the base, solitary, sometimes with secondary conidia; 2-3(4)-euseptate, 13-25 x 2.5-3.0 µm, acropleurogenous, dry, smooth, pale olivaceous, green in mass.

Teleomorph: unknown.

Habitat: On decaying runner-like stem attached to leaf of an unidentified plant, Rio Tinto, Brazil, legit J. Guarro, 14. IX. 1997.

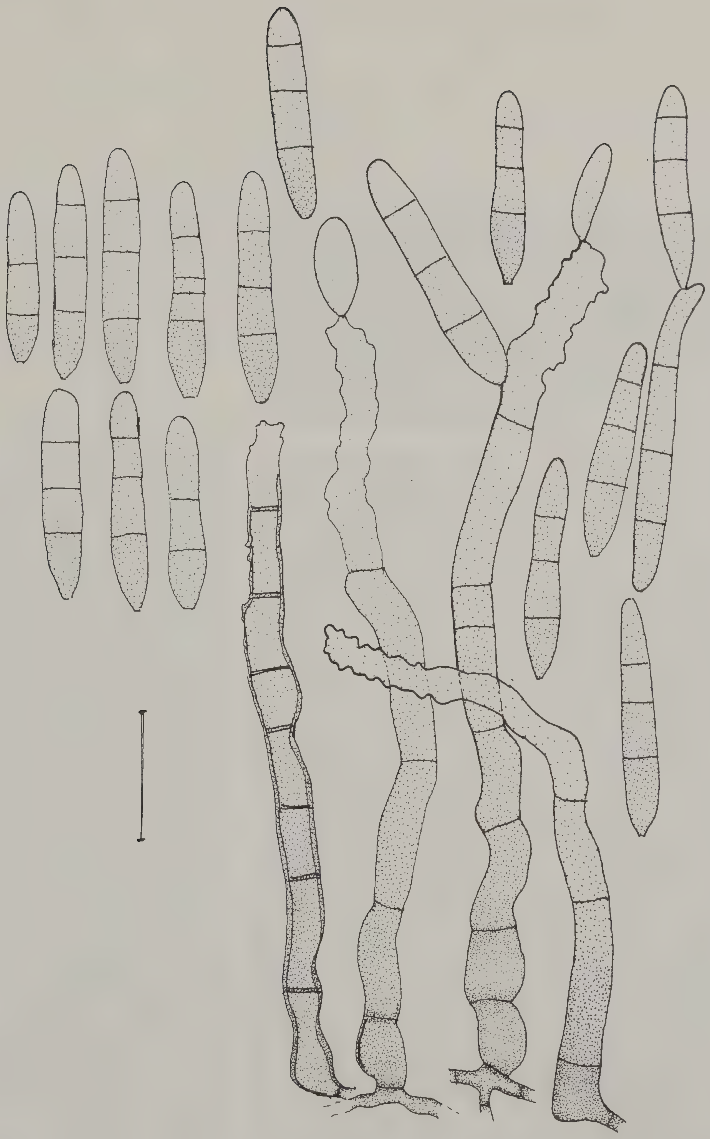

Fig. 1. *Minimelanolocus olivaceus* (MUCL 40706). Bar = 10 µm

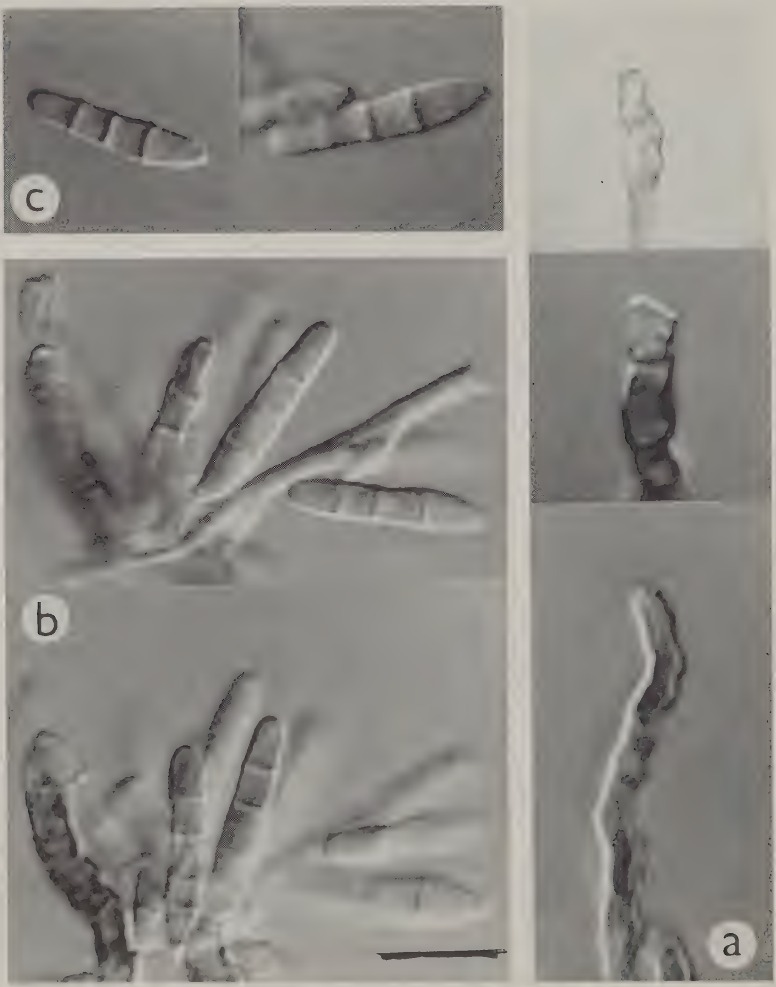

Fig. 2. *Minimelanolocus olivaceus* (MUCL 40706). Bar = 10 µm.

Holotype: MUCL 40706.

Colonies on corn meal-carrot extract agar attaining a diameter of 10-22 mm in two weeks at 25 ° C; olive to green and reversed dark green to black, with limited aerial mycelium, remained sterile.

Culture deposited: MUCL 40706 and FMR

Minimelanolocus miscanthi (Matsush.) R. F. Castañeda & Heredia (2001) (in Castañeda *et al.* 2001) superficially resembles *M. olivaceus*, but *M. miscanthi* has elliptic to cylindrical, pale olivaceous, 3-7-septate, 20-40 x 6-9 µm conidia. *M. olivaceus* strongly resembles *Sympodioplanus capensis* R. C. Sinclair & Boshoff in Sinclair, Boshoff and Eicker (1997) in conidial shape and size, but *S. capensis* has conidiogenous loci "flat in relation to the adjacent conidiogenous cell wall and not thickened, 1.5-2.2 µm wide" Sinclair *et al.* (1997), while in *M. olivaceus* the conidiogenous loci are inconspicuous or slightly protuberant, 0.5 µm wide. Also *S. capensis* has hyaline to pale brown conidia that are broadly truncate at the base, which are different from the conidia of *M. olivaceus*.

OTHER MICROFUNGI RECORDED FROM RAIN FORESTS IN BRAZIL.

Acumispora phragmospora Matsush., *Matsushima Mycological Memoirs* **1:** 3 (1980).
MUCL 41074, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Acumispora biseptata Matsush., *Matsushima Mycological Memoirs* **1:** 2 (1980).
MUCL 41093, ex rotten leaf, Rio Tinto, Brazil, coll. J. Guarro, 14. IX.1997.

Ardhachandra cristaspora (Matsush.) Subram. & Sudha, *Can. J. Bot.* **56:**731 (1979).
MUCL 41059, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Atrosetophiale flagelliformis Matsush., *Matsushima Mycological Memoirs* **8:** 14 (1981). Fig. 3
MUCL 41179, ex rotten leaf , Joao Pessoa, Brazil, coll. J. Guarro, 10.IX.1997.

Chaetopsina fulva Rambelli, *Atti Accad. Sci. Ist. Bologna Rc. Ser.* 11, 3: 5 (1956).
MUCL 41055, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Cylindrosympodium variabile (de Hoog) Kendrick & R. F. Castañeda *Univ. Waterloo Biol. Ser.* **32:** 10 (1990).
MUCL 41057, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Dactylaria fusiformis Shear & Crane, *Mycologia* **63:** 243 (1971).
MUCL 41091, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

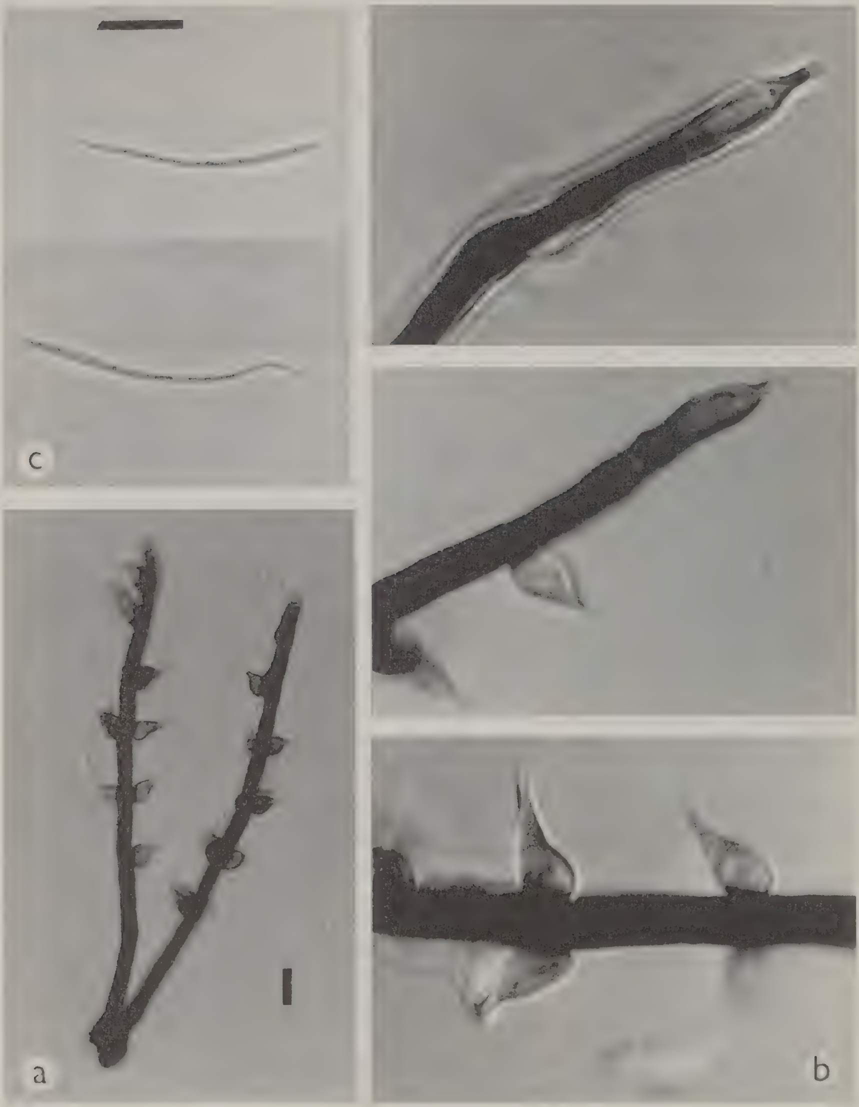

Fig. 3. *Atrosetophiale flagelliformis* (MUCL 41179). Bars = 10 µm.

Dactylaria zapatensis R. F. Castañeda, *Fungi Cubenses* **3:** 5 (1988).
MUCL 41049, ex rotten leaf, Rio Tinto, Brazil, coll. J. Guarro, 14. IX.1997.

Dictyochaeta gonytrichoides (Shearer & Crane) Kuthubutheen & Nawawi, *Mycol. Res.* **94:** 840-846 (1990).
MUCL 41171, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Dictyosporium micronesicum Matsush. *Matsushima Mycological Memoirs* **2:** 8 (1981).
MUCL 41163, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Fusariella hughesii Chabelska-Frydman, *Can. J. Bot.* **42:** 1485 (1964).
MUCL 41057, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Hemibeltrania malaysiana Matsush., *Matsushima Mycological Memoirs* **9:** 12 (1996).
MUCL 41067, ex rotten leaf, Rio Tinto, Brazil, coll. J. Guarro, 14. IX.1997.

Henicospora coronata B. Sutton & P. M. Kirk, in Kirk and Sutton, *Trans. Br. Mycol. Soc.* **75:** 249 (1980).
MUCL 41052, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Holubovaniella elegans R. F. Castañeda *Deuteromycotina de Cuba. Hyphomycetes* 3. *Inst. Inves. Fund. Agric. Trop.* 13 (1985).
MUCL 41052, ex rotten leaf, Rio Tinto, Brazil, coll. J. Guarro, 14. IX.1997. MUCL 41062, ex rotten leaf of unidentified *Lauraceae*, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Idriella cagnizari R. F. Castañeda & Kendrick, *Univ. Waterloo Biol. Ser.* **35:** 63 (1991).
MUCL 41060, ex rotten leaf, Rio Tinto, Brazil, coll. J. Guarro, 14. IX.1997.

Idriella rara R. F. Castañeda, *Deuteromycotina de Cuba. Hyphomycetes* 2. *Inst. Inves. Fund. Agric. Trop.* p. 6 (1985).
MUCL 41160, ex rotten leaf of unidentified *Lauraceae*, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Isthmolongispora minima Matsush., *Microfungi of the Solomon Islands and Papua-New Guinea*, Kobe, p. 30 (1971).
MUCL 41173, ex rotten leaf , Joao Pessoa, Brazil, coll. J. Guarro, 10.IX.1997.

Myrothecium setiramosum R. F. Castañeda, *Deuteromycotina de Cuba. Hyphomycetes* 4. *Inst. Inves. Fund. Agric. Trop.*, p.10 (1986).

MUCL 41080, ex rotten leaf, Joao Pessoa, Brazil, coll. J. Guarro, 10.IX.1997. MUCL 41083, ex rotten leaf, Joao Pessoa, Brazil, coll. J. Guarro, 10.IX.1997. MUCL 41087, ex rotten leaf, Joao Pessoa, Brazil, coll. J. Guarro, 10.IX.1997.

Parasympodiella laxa (Subram. & Vittal) Ponnappa, *Trans. Br. Mycol. Soc.* **64:** 344 (1975).
MUCL 41186, ex rotten leaf, Joao Pessoa, Brazil, coll. J. Guarro, 10.IX.1997.

Parapleurotheciopsis inaequiseptata (Matsush.) P. M. Kirk, *Trans. Br. Mycol. Soc.* **78:** 65 (1982).
MUCL 41089, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, coll. J. Guarro, 10.IX.1997.

Parasympodiella laxa (Subram. & Vittal) Ponnappa, *Trans. Br. Mycol. Soc.* **64:** 344 (1975).
MUCL 41168, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, col J. Guarro, 10.IX.1997.

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MUCL 41052, ex rotten leaf, Mata Avenca-Santa Rita, Brazil, col J. Guarro, 10.IX.1997.

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MYCOTAXON

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NOTES ON THE GENUS PITHOMYCES (HYPHOMYCETES) FROM CHINA

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Abstract: Three new species and four new records of *Pithomyces* are reported. The type specimens are deposited in Herbarium of Department of Plant Pathology of Shandong Agricultural University (HSAUP).

Key words: new species, *Pithomyces gladioli, P. clavisporopsis*, *P. saccharicola*, new records, *P. graminicola*. *P. maydicus*, *P. sacchari, P. chartarum*

Pithomyces gladioli X. G. Zhang & T. Y. Zhang sp. nov. Fig. 1

Coloniae pulvinatae vel effusae, pallide brunneae, Mycelium superficiale ex hyphis ramosis, septatis, subhyalinis vel pallide brunneis, laevibus. 2.0-2.5μm crassis reticulates compositum. Conidiophora singularia ex apicibus lateralibusque hypharum oriunda, simplicia, recta vel flexuosa, cylindrica, brunnea, laevia, 2.5-3.0μm longa, 1.5-2.0μm crassa. Conidia singularia in apice conidiophori oriunda, recta vel curvata, ellipsoidea, oblonga vel obovoidea, brunnea vel fusca, laevia, 23-32 μ m longa, 9.5-12μm crassa, transversaliter 3-5-septata, longitudinaliter vel obliqueve 0-3-septata, ad septa transversa distincte constricta.

Hab. in foliis *Gladiolus communis* L., Nanchang, Jiangxi Provincia, Sina, 2 VIII 2000, leg. X. G. Zhang, HSAUP 20464, Holotypus.

Colonies pulvinate or effuse on PCA at 28℃, pale brown, Mycelium superficial, composed of a network of branched, septate, subhyaline or pale brown, smooth-walled, hyphae 2.0-2.5μm wide. Conidiophores reduced to very short lateral branches on the hyphae. Conidia formed singly as blown-out apices of short side branches, straight or curved,

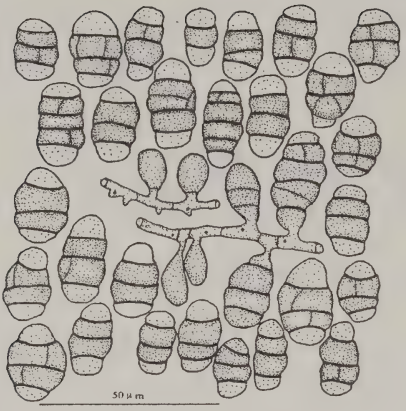

Fig. 1 Conidia and conidiophores of *P. gladioli*

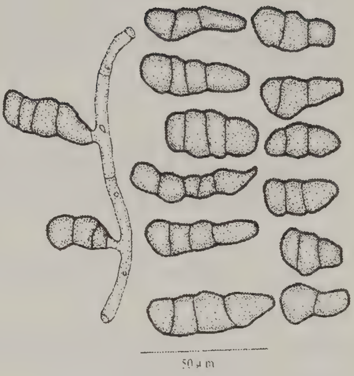

Fig. 2 Conidia and conidiophores of *P. clavisporopsis*

ellipsoid, oblong or obovoid, brown to dark blackish brown, smooth, 23-32μm long, 9.5-12μm wide in the broadest part, with 3-5 transverse and 0-3 longitudinal or oblique septa, distinctly constricted at transverse septa.

Pithomyces gladioli is similar in conidium morphology to *Pithomyces elaeidicola* M. B. Ellis and *Pithomyces atro-olivaceus* (Cooke & Hark.) M. B. Ellis (1960, 1971). However, the following three distinct differences are very useful in distinguishing these taxa. The conidia of *P. gladioli* are much smaller, 23-32 × 9.5-12μm, while those of the other two species are 33-55 × 15-24μm and 28-45 × 15-26μm, respectively. Most conidia of *P. gladioli* have 3-5 constricted transverse septa, but conidia of both *Pithomyces elaeidicola* and *Pithomyces atro-olivaceus* have 5-6 constricted transverse septa. Conidia of *P. gladioli* are smooth-walled, but those of the other two species are verrucose.

Pithomyces clavisporopsis X. G. Zhang & T. Y. Zhang sp. nov. Fig. 2

Coloniae pulvinatae vel effusae, pallide brunneae. Mycelium superficiale ex hyphis ramosis, septatis, subhyalinis vel stramineis, laevibus, 1.5-3.0μm crassis reticulatis compositum. Conidiophora singularia ex lateralibus hypharum oriunda, simplicia, recta vel flexuosa, cylindrica, pallide straminea, laevia, 2.0-3.0μm longa, 1.5-2.0μm crassa. Conidia singularia in apice conidiophori oriunda, recta vel curvata, oblonga vel clavata, pallide-brunnea, laevia, 13-27μm longa, 6.5-8.5μm crassa, transverse 1-4-septata, septa longitudinalia et oblique nulla vel raro, ad septa transversa distincte constricta.

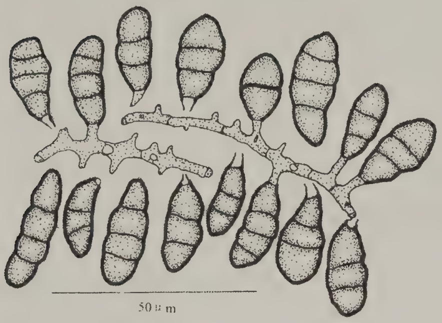

Fig. 3 Conidia and conidiophores of *P. saccharicola*

Hab. in foliis *Lilium amoenum* Wilson ex Sealy., Guilin, Guangxi Provincia, Sina, 31VIII 1999, leg. X.G. Zhang, HSAUP 990852, Holotypus.

Colonies pulvinate or effuse on PCA at 28℃, pale brown. Mycelium superficial, composed of a network of branched, septate, subhyaline or straw coloured, smooth-walled, hyphae 1.5-3.0μm wide. Conidiophores reduced to very short lateral branches on the hyphae. Conidia formed singly as blown-out ends of short hyphal branches, straight or curved, clavate or oblong, pale brown, smooth, 13-27μm long, 6.5-8.5μm wide in the broadest part, with 1-4 transverse septa, longitudinal and oblique septa absent or very rare, distinctly constricted at septa.

The most closely related species in conidial morphology are *Pithomyces clavisporus* Morgan-Jones (1987) and *Pithomyces graminicola* R. Y. Roy & B. Rai (Roy & Rai, 1968). The new taxon can be separated from those two species by conidial septation, size range and wall ornamentation. The distinctly verrucose conidia of *Pithomyces clavisporus* provide a striking character differentiating it from *Pithomyces clavisporopsis* and *Pithomyces graminicola*.

Pithomyces saccharicola X. G. Zhang & T. Y. Zhang sp. nov. Fig. 3

Coloniae pulvinatae vel effusae, pallide brunneae. Mycelium superficiale ex hyphis ramosis, septatis, subhyalinis ad pallide brunneis, laevibus, 1.5-3.5μm crassis, reticulatis compositum. Conidiophora singularia ex lateralibus hypharum oriunda, simplicia, recta vel flexuosa, cylindrica, pallide brunnea, laevia, 3.5-5.5μm longa, 1.5-2.0μm crassa. Conidia singularia in apice conidiophori oriunda, recta vel curvata, ellipsoideo-oblonga, obovoidea vel obpyriformia, pallide-brunnea, laevia, 17-29μm longa, 7.5-11.5μm crassa, transverse 1-3-septata, septa longitudinalia vel obliqua nulla, septa transversa distincte constricta, ad basim subacuta vel conica, ad apicem rotundata vel subtruncata. Hab. in foliis *Saccharum officinarum* L., Nanning, Guangxi Provincia, Sina, 17 VIII 1999, leg. X. G. Zhang, HSAUP 991114, Holotypus.

Colonies pulvinate or effuse on PCA at 28℃. Mycelium superficial, composed of a network of branched, septate, subhyaline to pale brown, smooth-walled, 1.5-3.5μm wide hyphae. Conidiophores reduced to very short lateral branches singly on the hyphae. Conidia formed singly as blown-out ends of very short side branches, straight or curved, oblong-ellipsoid, obovoid or obpyriform, pale brown, smooth, 17-29μm long, 7.0-11.5μm wide in the broadest part, with 1-3 transverse septa, longitudinal and oblique septa absent or very rare, distinctly constricted at septa, subacute or conical at the base, rounded or subtruncate at apex.

In conidial morphology, this species is close to *Pithomyces pavgii* (V. R. Nath) Palm, E. R. Stewart & Rossman (Palm & Stewart, 1981) and *Pithomyces graminicola*. They are similar in shape of the conidia. However, The new taxon can be separated from the other two species by its conidia with fewer transverse and no longitudinal or oblique septa, and smooth walls. Conidia of *Pithomyces pavgii* and *Pithomyces graminicola* (1968) have 1-2 longitudinal or oblique septa and are smooth or verrucose-walled, respectively. Another striking character in that the conidial size range in the new taxon is greater than those of the other two species.

New Records from China

Pithomyces graminicola R. Y. Roy & B. Rai, 1968, Trans. Br. Mycol. Soc., 51: 152-155

On leaves of *Mangifera indica* L., Nanning, Guangxi Province, 10 IX. 1999. Coll. X. G. Zhang, ZXG99-904 (HSAUP 991104).

Pithomyces maydicus (Sacc) M. B. Ellis, 1960, Mycol Pap., 6: 15

On leaves of *Trachycarpus fortunei* Wendland., Gueilin, Guangxi

Province, 10 X, 1999. Coll. X.G. Zhang, ZXG990-575 (HSAUP 990775).

Pithomyces sacchari (Speg) M. B. Ellis, 1960, Mycol Pap., 76: 17-18

On leaves of *Ficus altissima* BL., Beihai, Guangxi Province, 10 X, 1999. Coll. X. G. Zhang, ZXG990-407 (HSAUP 990607).

Pithomyces chartarum (Berk. & M. A. Curtis) M. B. Ellis, 1960, Mycol Pap., 76: 13-15

On leaves of *Ananas comosus* (L) Merr., Wuhan, Hubei Province, 9 XIII, 1999. Coll. X. G. Zhang, ZXG990-101 (HSAUP 990301).

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TAXONOMIC STUDIES OF STEMPHYLIUM FROM CHINA

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Abstract: Four new species of *Stemphylium* are described and illustrated: *S. gossypii*, *S. lactuci*, *S. momordi* and *S. alli-cepae*. The type specimens of the new species are deposited the in Herbarium of the Department of Plant Pathology of Shandong Agricultural University (HSAUP).

Key words: Hyphomycetes, new species, *Stemphylium gossypii, S. lactuci, S. momordi* and *S. allii-cepae*

Stemphylium gossypii X. G. Zhang & T. Y. Zhang, sp. nov. Fig. 1

Coloniae effusae, pallide brunneae. Mycelium superficiale: hyphae ramosae, septatae, pallide brunneae, laeves, 2.5-4.5μm latae. Conidiophora solitaria, laevia, recta vel curvata, nonramosa vel raro ramosa, pallide brunnea, cylindrica, 4-5-septata, 82-126 × 3.5-5.5μm, ad apicem tumida usque ad 6-8μm, Conidia singularia pallide brunnea, oblonga-ellipsoidea vel oblonga, ad apicem subacuta vel conica, ad basim rotundata vel subtruncata, recta vel curvata, laevia, 1-transverse septata, ad plures longitudinaliter vel oblique septata, 39-61 × 17-31μm.

Hab. in foliis vivis *Gossypium hirsutum* L., Taian, Shandong Provincia, Sina, 12 VIII 2000, leg. X. G. Zhang, Holotypus: HSAUP 20250.

Colonies on PCA effuse, pale brown. Mycelium superficial: hyphae branched, septate, pale brown, smooth, 2.5-4.5μm wide. Conidiophores solitary, simple or occasionally branched, straight or slightly curved, smooth, light brown, cylindrical, 4-5-septate, 82-126 × 3.5-5.5μm, but 6-8μm at the swollen apex. Conidia pale brown, oblong-ellipsoid or oblong, subacute or conical at the apex, rounded or subtruncate at the base, straight or slightly curved, smooth-walled, with 1 transverse septum and several longitudinal or oblique septa, always distinctly constricted at the median transverse septum, 40-68 × 17-35μm.

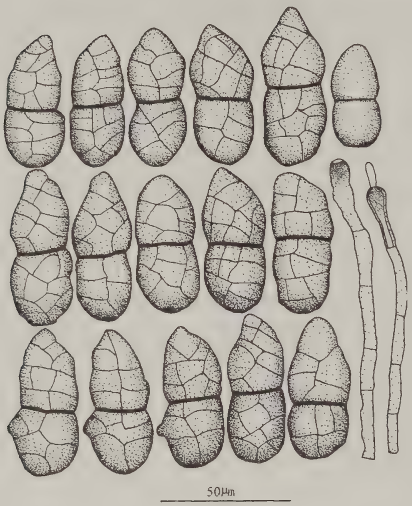

Fig.1 Conidia and conidiophores of *S.gossypii*

The shape of conidia in *Stemphylium gossypii* is close to that in *Stemphylium callistephi* (Baker & Davis, 1950) and *S. solani* (Weber, 1930). The conidia of *S. gossypii, S. callistephi* and *S. solani* reach a size range of av. 54 × 26μm, av. 70 × 32μm and av. 45 × 22μm, respectively, which indicates that the size range of conidia in the new taxon is larger than that of *S. solani* and smaller than that of *S. callistephi*. In addition, conidia of the new taxon always have one constricted transverse septum, whereas *S. callistephi* usually has two constricted transverse septa. The conidia of the new taxon are less rounded at the base and smooth-walled which provide the necessary characters to distinguish it from *S. solani*, which usually has broadly round-based and verrucose-walled conidia. All of these characters of the new taxon can readily separate it from both well-known species.

Stemphylium lactuci X. G. Zhang & T. Y Zhang, sp. nov. Fig. 2

Coloniae effusae, pallide brunneae vel brunneae. Mycelium superficicale hyphae ramosae, septatae, pallide brunneae, leaves, 1.5-3.5μm latae. Conidiophora singularia, recta vel curvata, simplicia vel raro ramosa, medio-brunneae vel brunneae, cylindrica, 3-5-septata, 43-65 × 4.5-7.5μm, ad apicem in saepissime 1 proliferationis usque 5-7μm laevia. Conidia singularia medio-brunnea vel brunnea, ovoidea, obovoidea, oblonga-ellipsoidea vel clavata, recta vel curvata, laevia, 1-3-transverse septata, 0-2 longitudinaliter vel 0-2-oblique septata, distincte constricta, 28-50 × 14-32μm, laevibus.

Hab. in foliis vivis *Lactuca sativa* L., Hefei, Anhuei Provincia, Sina, 20 VIII 2000, leg. X. G. Zhang, Holotypus: HSAUP 20852.

Colonies on PCA effuse, pale brown to brown. Mycelium superficial; hyphae branched, septate, pale brown, smooth, 1.5-3.5μm wide. Conidiophores solitary, unbranched or occasionally branched, straight or slightly curved, brown, smooth, cylindrical, swollen at the apex 5-7μm diam and distinctly flared, 3-5-septate, 43-65 × 4.5-7.5μm, Conidia solitary, brown, ovoid, obovoid, oblong-ellipsoid or clavate, straight or slightly curved, with 1-3 distinctly constricted transverse septa, and 0-2 longitudinal or oblique septa 28-53 × 14-32.5μm, smooth-walled.

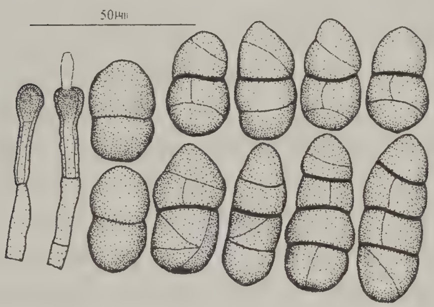

Fig. 2 Conidia and conidiophores of *S. lactuci*

The conidial shape in *S. lactuci* is similar to that of *S. callistephi* (Baker & Davis, 1950), but the two can be separated by conidium size range and septation. The conidia of *S. callistephi* and *S. lactuci* reach a size range of 50-70 × 22-30μm (av. 60 × 26μm) and 28-53 × 14-32μm (av. 42 × 19μm), respectively. Therefore, the size range of *S. callistephi* conidia is is greater than that of the new taxon. Meanwhile, the mature conidia of *S. lactuci* has fewer transverse septa (1-3) than those of *S. callistephi* (3-8). Besides, the apical conidium cell of *S .callistephi* is often strikingly conical, while that of the new taxon is often rounded or less conical.

Stemphylium momordi X. G. Zhang & T.Y. Zhang, sp. nov. Fig. 3

Ex culturis in agaro PCA descripta, coloniae effusae, medio-brunneae vel brunneae. Mycelium superficiale ex hyphis ramosis, septatis, brunneis, laevibus, 2.0-4.5μm crassis compositum. Conidiophora singula, recta, wont amosa vel raro ramosa, medio-brunnea vel brunnea, cylindrica, 2-3-septata, 64-94 × 5.5-8.5μm, saepissime in apice ad 1 proliferationis usque 7-9μm inflata, laevibus. Conidia singula in apice conidiophori et dein proliferationis cujusque successivae oriunda, medio-brunnea vel brunnea, oblonga, cylindrica, recta, transverse 2-4-septata, longitudinaliter vel oblique 3-11-septata, 34-71 × 12-21μm, laevibus.

Hab. in foliis vivis *Momordica charantia* L., Changsha, Hunan Provincia, Sina, 9 VIII 2000, X. G Zhang, Holotypus: HSAUP 20859.

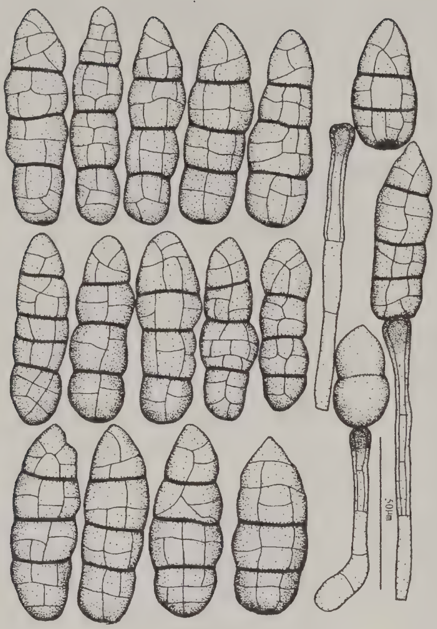

Fig. 3 Conidia and conidiophores of *S. momordi*

Colonies on PCA spreading, medium brown to brown. Mycelium superficial, composed of branched, septate, brown, smooth, hyphae 2.0-4.5μm wide. Conidiophores unbranched or occasionally branched, straight, medium brown to brown, cylindrical except at apical proliferations which are swollen or distinctly flared, 2-3-septate, 64-94 × 5.5-8.5μm, wider apically up to 7-9μm, smooth. Conidia develop singly through a wide pore at the apex of each conidiophore, medium brown to brown, oblong, cylindrical, straight, smooth, with 2-4 thicker and darker transverse septa and 3-11 septa, longitudinal or oblique septa; distinctly constricted at the 2-4 main transverse septa, smooth-walled. 34-71 × 12-21μm, L/W ratio 3.2-4.5 in mature conidia.

The shape of conidia in *S. momordi* is similar to that in *S. floridanum* (Hannon and Weber, 1955) and *S. callistephi* (Baker & Davis, 1950). *S. momordi* can be separated from *S. callistephi* by its L/W ratio of 3.2-4.5 (*S. callistephi* has an L/W ratio of 2.1-2.5). Otherwise, the conidia walls of the new taxon are often smooth, while those of *S. floridanum* are often verrucose. In addition, most of the mature conidia of the new taxon are less acute at the apex than those of the other well-known species.

Stemphylium allii-cepae X. G. Zhang & T. Y. Zhang, sp nov. Fig. 4

Ex culturis in agaro PCA descripta, coloniae effusae, pallide vel medio-brunneae. Mycelium superficiale ex hyphis ramosis, septatis, pallide brunneis, laevibus, 3.5-5.5μm crassis compositum. Conidiophora singula, recta vel curvata, simplicia vel raro ramosa, medio-brunnea vel brunnea, laevia, cylindrica, 1-2-septata, 59-72 × 5.5-6.5μm, saepissime in apice ad 1 proliferationis usque 9-11μm inflata, laevibus. Conidia singula in apice conidiophori et in proliferationis cujusque successivae oriunda, medio-brunnea vel brunnea, oblonga, obclavata, in apice subacuto vel conico, ad basim subtruncata, recta vel curvata, laevibus, ad septa majora transversa distincte constricta, longitudinaliter 0-1, vel oblique 2-4-septata, 28-53 × 7.5-18.5μm, laevibus.

Hab. in foliis vivis *Allium cepa* L., Hefei, Anhuei Provincia, 17 VIII 2000, X. G. Zhang, Holotypus: HSAUP 20650.

Colonies effuse on PCA, light brown to medium brown. Mycelium superficial, composed of branched, septate, pale brown, smooth-walled, hyphae 3.5-5.5μm wide. Conidiophores simple or occasionally branched, straight or curved, medium brown to brown, cylindrical except at the apical proliferations which are swollen or distinctly flared, 1-2-septate, 59-72 × 5.5-6.5μm, flared apically up to 9-11μm, smooth. Conidia develop singly through a wide pore at the apex of each conidiophore, medium brown to brown, oblong to obclavate, subacute or conical at the apex, straight or slightly curved, smooth-walled, with 1 thicker and darker pigmented transverse septum at the median constriction, 0-1 longitudinal and 2-4 strongly oblique septa, 28-53 × 7.5-18μm, L/W ratio of 2.5-3.2 in mature conidia.

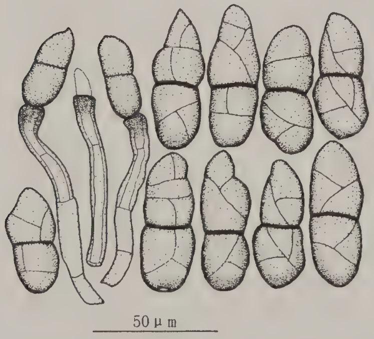

Fig.4Conidia and conidiophores of *S. allii-cepae*

The conidium shape of this species is similar to that of *Stemphylium solani* (Weber, 1930) and *S. bolickii* (Sobers & Seymour, 1950). But the conidium of *S. allii-cepae* has generally only one median septum at which it is constricted, whereas that of *S. bolickii* usually has 3-4 such transverse septa. On the other hand, the conidial L/W ratio of *S. allii-cepae* and *S. solani* are 2.1-2.5 and 2.0, respectively. The L/W ratio of this new taxon is larger than that of *S. solani*. The smooth walls of the conidia in this new taxon distinctly differentiate it from the verrucose-walled conidia of *S. solani* and *S. bolickii*.

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A NEW SPECIES OF MEMNONIELLA

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Abstract

A new species of hyphomycetes, *Memnoniella longistipitata* anam. sp. nov., is described and illustrated. This fungus was originally isolated from forest soil in Japan.

Key words: Hyphomycetes, *Memnoniella longistipitata*, *Stachybotrys*.

Introduction

Six species have been described in the mitosporic genus *Memnoniella* Höhnel: *M. echinata* (Rivolta) Galloway (=*M. aterrima* Höhn.), *M. levispora* Subramanian, *M. subsimplex* (Cooke) Deighton, *M. zingiberis* Rao, *M. stilboidea* (Munjal & Kapoor) Ellis, and *M. leprosa* Castañeda. Members of this genus did not attract much attention until several years ago, when public awareness of the apparent potential negative effects of indoor fungi on human health became an issue, and the ubiquitous and toxigenic *Stachybotrys* achieved considerable notoriety. There are several similarities between *Memnoniella echinata* and *Stachybotrys chartarum*: (1) widespread distribution, (2) production of an overlapping spectrum of mycotoxins, including trichothecenes, (3) saprobic lifestyles in indoor habitats (water-damaged buildings), (4) cellulolytic activities (the paper on damp wallboard), and (5) close phylogenetic relationships. During comparative sequence studies of *Stachybotrys* and *Memnoniella* to determine their phylogenetic relationships, one isolate (ATCC 22699) collected and deposited by T. Matsushima under the name of *M. subsimplex*, was found to be genetically different from both *M. subsimplex* and *M. echinata* (Haugland and Heckman, 1998; Haugland, Vesper and Harman, 2001). Further study at P & K Microbiology Services laboratory revealed that this isolate has distinctive morphological characteristics. The culture is therefore described as a new species.

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Memnoniella longistipitata D. W. Li, Chin S. Yang, Vesper et Haugland sp. nov. Figures 1-4.

Fungi mitosporici, Hyphomycetes.

Coloniae in MEA, 27 mm diam. in 21 diebus ad 25°C, grisea; margina irregularia, massas conidiarum granulatae.

Conidiophora longissima, distincta, solitaria vel interdum fasciculata, determinata, erecta, recta vel exigue curvata, non ramosa, (170-) 260–460 (-610) μm longa (‾ = 266 μm) and (3.2-) 3.6 - 4.7 (-4.9) μm crassa, primo hyalina, deinde olivacea, verrucosa, apice inflata.

Cellulae conidiogenae phialidicae, determinatae, discretae, laeviae, obovatae vel ellipsoideae vel clavatae, pallide olivaceae, 3-9 in verticillo dispositae, 9.7-10.2 × 4.7-5.5 μm, collulo conspicuo praeditae.

Conidia catenata, aliquando in extremis complanata, primo hyalina, laevia, deinde agro-olivacea vel nigra, sphaerica vel subsphaerica, echinulatae (tuberculatae), 5.8-8.5 × 6.3- 8.3 μm. Aliquot conidia (1% ad 5%) simile *Stachybotrys* formans: oblonga vel ovoidea, atro-olivacea in massis globosis aggregata, laevia vel verrucosa, 10.5-12 × 4.8-5.7 μm.

Teleomorphosis ignota.

Holotypus ATCC 22699 ex solo sylvarum isolatus, Japan.

Mitosporic fungi, Hyphomycetes.

Colonies reaching 27 mm in diameter in 3 weeks at 25°C on malt extract agar, becoming grayish and granular with the production of conidia (Figure 1).

Conidiophores very long, distinct, single, occasionally in groups, determinate, erect, straight or slightly curved, unbranched, (170-) 260–460 (-610) μm long (mean = 266 μm) and (3.2-) 3.6-4.7 (-4.9) μm wide (Figure 2), colourless at first, later becoming olivaceous and roughened (Fgiures 2, 3). Slightly enlarged apex bearing 3-9 phialides in a terminal whorl.

Phialides determinate, discrete, smooth, obovoid to ellipsoidal to clavate, light olivaceous, 9.7-10.2 × 4.7-5.5 μm, with noticeable collarettes (Figure 3).

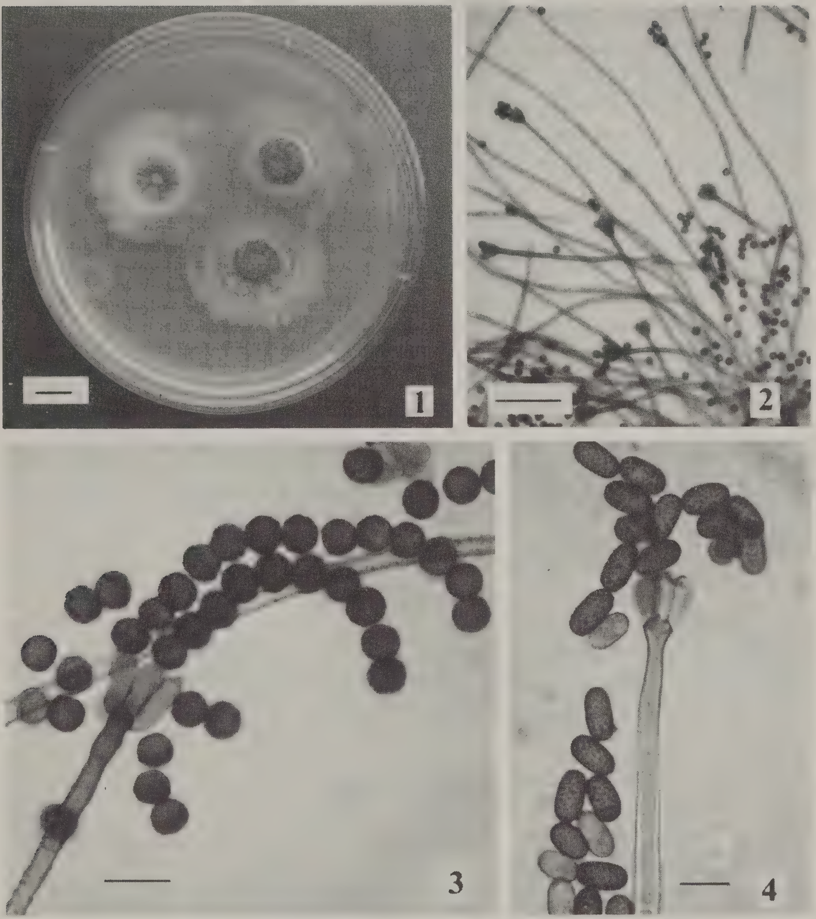
Conidia catenate, acrogenous, in basipetal succession, spherical or subspherical, sometimes flattened at the ends, colourless and smooth at first but becoming dark olivaceous or black, warty, 5.8-8.5 × 6.3-8.3 μm at maturity (Figure 3). This species also develops 1%-5% *Stachybotrys*-type conidia which are oblong or ovoid, dark olivaceous, smooth-walled to slightly rough, 10.6-11.9 × 4.8-5.7 μm, aggregated in slimy masses (Figure 4).

Teleomorph unknown

Holotype: Dried specimen derived from a culture ATCC 22699 from a specimen collected in Japan by T. Matsushima. Isotypes are deposited in BPI, CUP, CBS, DAOM, and IMI. Living cultures maintained at ATCC (ATCC22699).

Etymology: the specific epithet refers to the long stipe of this species.

This species is very similar to *M. subsimplex* (Cooke) Deighton (Deighton 1960). The isolate used in the study was deposited at ATCC by the collector, T. Matsushima, under



Figs. 1-4. *Memnoniella longistipitata*. 1. Colonies on MEA after 3 weeks. 2. Long conidiophores. 3. Conidiophore, phialides, and conidia. 4. *Stachybotrys*-type conidia. Bars = 10 μm (in Figs 3, 4), 40 μm (in Figure 2), 10 mm (in Figure 1), respectively.

the name of *M. subsimplex*, but conidia of *M. subsimplex* are coarsely warted, only 6-9 μm in diameter, and the species develops much shorter conidiophores. *M. echinata* (Riv.) Galloway is another similar species, but has smaller conidia, 3-6 μm in diameter. Zuck (1946) observed that *M. echinata* developed both *Memnoniella*- and *Stachybotrys*-type conidia. *M. longistipitata* also develops some *Stachybotrys*-type conidia in slimy heads at the edge of the colonies. However, phylogenetic and specific PCR primer studies using sequence analysis of rDNA showed that *M. longistipitata* is genetically different from *M. subsimplex* and *M. echinata* (Haugland and Heckman, 1998; Haugland, Vesper and Harman, 2001). Other similar species are *M. levispora* Subram. (1954) which has smooth-walled conidia, often hemisphaerical, 5 (3-7) µm in diameter; *M. zingiberis* Vasant Rao (1962) which has perfectly globose, warty conidia, (4.4-) 6-6.5 (-6.8) µm diam; and both *M. stilboidea* (Ellis, 1976) and *M. leprosa* (Castañeda, 1986) which are synnematous. Jong and Davis, (1976) considered that *M. zingiberis* is possibly a synonym of *M. echinata*. However the studies of Haugland, et al. (2001) indicated a closer genetic similarity between *M. zingiberis* and *M. subsimplex*.

Separation of *Stachybotrys* and *Memnoniella* has been controversial over the past 40 years. Smith (1962) considered that dry conidia in chains, as in *Memnoniella,* and slimy aggregated conidia, as in *Stachybotrys,* were not sufficient to separate them into two genera and demoted *Memnoniella* to synonymy with *Stachybotrys*. Kendrick and Carmichael (1973), Barron (1968) and Carmichael et al. (1980) concurred with Smith's treatment. Zuck (1946) observed that *M. echinata* developed conidia in both dry chains and slimy aggregates. Our observation of a number of isolates of *M. echinata* confirmed his results. *Memnoniella longistipitata* also developed both types of conidia. Zuck (1946) considered the isolates that developed both types of conidia were intermediate between *Stachybotrys* and *Memnoniella*. A study using comparative sequence analysis of species of *Stachybotrys* and *Memnoniella* convinced Haugland et al. (2001) that the names of *Stachybotrys echinata* (Rivolta) Smith and *Stachybotrys subsimplex* Cooke 1883 should be revived. Further studies are necessary before the fate of *Memnoniella* can be decided. Since *Memnoniella* is apparently still accepted, our new species is placed in this genus.

Acknowledgments

The authors are very grateful to Drs. Bryce Kendrick and Richard Korf, Professors Emeritus of The University of Waterloo and Cornell University respectively for their critical review of the manuscript and suggestions, and to Brian Kerin for technical support.

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TYPE STUDIES IN AGARICACEAE – CHLOROPHYLLUM RACHODES AND ALLIES

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The complex of *Chlorophyllum rachodes* in Europe and North America was investigated, and type collections or authentic material of *Lepiota brunnea*, *L. bohemica*, *L. subrhacodes,* and *Macrolepiota venenata* were studied. *Chlorophyllum brunneum* is shown to be the correct name for what was known as *M. rachodes* var. *hortensis* and var. *bohemica*. Diagnostic characters comprise the structure of the annulus and the bulb, shape and size of spores and cheilocystidia, and the clamp-connections. Five species are recognized: *Chl. rachodes*, *Chl. olivieri, Chl. brunneum, Chl. subrhacodes*, and *M. venenata*. A key to the species and an overview of the different interpretations of the names are provided.

Introduction

The species complex of *Chlorophyllum rachodes* (Vittad.) Vellinga (2002) (syn. *Macrolepiota rachodes* (Vittad.) Singer) has been the subject of many controversies and papers. The status of the names 'hortensis', 'bohemica', 'brunnea', ‘olivieri’, 'venenata', and 'rachodes' continues to be disputed and the delimitation of these taxa and their proper rank are still unresolved. Most of the papers on these species are European, but the species in question occur also in North America. The distribution in other parts of the world is not fully known yet, though the name ‘rachodes’ has certainly been used (e.g. Pegler (1977) for specimens found in East Africa; Bougher & Syme (1998) for an Australian species), but it cannot be *a priori* assumed that these descriptions refer to the same species as the European one.

This paper focuses on two questions: i. what species exist in Europe and North America and how can they be recognized? ii. what are the correct names for these taxa?

Type collections of *Lepiota brunnea* Farl. & Burt, and *Lepiota subrhacodes* Murrill were studied, along with original material of *Lepiota bohemica* Wichansky and *Macrolepiota venenata* Bon. As Pilát did not designate a type collection for his taxon *Lepiota rhacodes* var. *hortensis*, none of his collections was studied. Indeed, though he introduced his taxon twice (Pilát, 1951; Pilát & Us˘ak, 1952; see Bellù & Lanzoni, 1987; de Kok & Vellinga, 1998) the name was never validly published because a Latin diagnosis was omitted.

Some species, such as *M. venenata*, are considered toxic. In western North America, what is known there as *Lepiota rhacodes* var. *hortensis*, causes gastrointestinal problem when it has green tinges in the gills and between gills and stipe. *Chlorophyllum rachodes,* on the other hand, is a sought-after edible. To the uninitiated eye all the taxa look very similar. To discriminate between those species and to facilitate identification of European and North American material, a key to all accepted taxa is provided, with drawings of spores and cheilocystidia. A table (Table I) with all the names and an overview of the different interpretations of those names is also given, as an aid for understanding the existing literature on this confusing group.

All herbarium material was revived in a solution of Congo Red in ammonia. The drawings of microscopical characters were made using a drawing tube.

The notation 'Spores [45]' indicates that measurements were made on 45 spores from one sample of one basidiocarp, whereas [46,4,3] indicates that the measurements were made on 46 spores from four samples in three collections. The following abbreviations are used: avl (average length), avw (average width), Q (quotient of length and width), and avQ (average quotient). Abbreviations of herbaria are from Holmgren et al. (1990).

Bohemica – Fig. 1.

Lepiota bohemica Wichansky in Mykol. Sb. 38: 103. 1961 (not valid; type collection not indicated); *Macrolepiota bohemica* (Wichansky) Krieglst. in Z. Mykol. 47: 83. 1981 (not valid, basionym not mentioned); *Macrolepiota bohemica* (Wichansky) Krieglst. & Pázmány in Z. Mykol. 51: 52. 1985 (not valid); *Macrolepiota rachodes* var. *bohemica* (Wichansky) Bellù & Lanzoni in Beitr. Kenntn. Pilze Mitteleur. 3: 191. 1987 (not valid).

Wichansky provided a range of dates for his collections (27-XI-1960—12-XII-1960, and 4-V-1961—30-V-1961) but did not select one date for his type. Only one collection in PRM falls within these ranges, viz that collected 10-V-1961, and strangely enough this collection is labeled '*L. rhacodes* var. *hortensis*', and was identified by Pilát. A second collection labeled '*L. bohemica*', was identified by Wichansky, but it was collected several years later, and in a different place (see collections examined).

The 1961 collection consists of two small basidiocarps, with simple annulus, and marginate bulb, which is wider than high. The following microscopical characters were noted:

Spores [25] 9.9-11.8 x 7.1-8.1 μm, avl x avw = 10.8 x 7.5 μm, Q = 1.35-1.6, avQ = 1.45, ellipsoid-amygdaloid with truncate apex in side-view, ellipsoid-ovoid with truncate apex in frontal view, with wide apical germ pore and thickened wall, congophilous, dextrinoid, and metachromatic in Cresyl Blue. Basidia 33-43 x 9.0-11 μm, 4-spored, with basal clamp-connection. Lamella edge sterile, with a broad band of cheilocystidia. Cheilocystidia 33-47 x 10-16.5 μm, clavate, to utriform, a very few spheropedunculate, with brown contents. Pileus covering (central patch) a hymeniderm of tightly packed elements, 55-87 x 6-13 μm, broadened at apex in most cases; the narrower elements with brown intracellular pigment, the widened ones mostly colourless. Stipitipellis a cutis of 5-10 μm wide cylindrical, brown-walled hyphae. Clamp-connections present, at least at base of basidia and cheilocystidia.

The second collection has the following spore and cystidia characters:

Spores [15] 8.8-11.1 x 6.4-7.7 μm, avl x avw = 10.1 x 7.2 μm, Q = 1.3-1.5, avQ = 1.4. Cheilocystidia 36-50 x 7.5-12 μm, cylindrical-clavate, narrowly clavate or clavate.

The collection made by Wichansky in 1961 is here selected as the lectotype of the species.

Specimens of this taxon were described initially as relatively small (Wichansky, 1961), but later large ones were included as well (e.g. Candusso & Lanzoni, 1990); all share the marginate bulb, the simple annulus, and the predominantly clavate cheilocystidia. The stipe is often curved, as Wichansky's illustration (1962) showed.

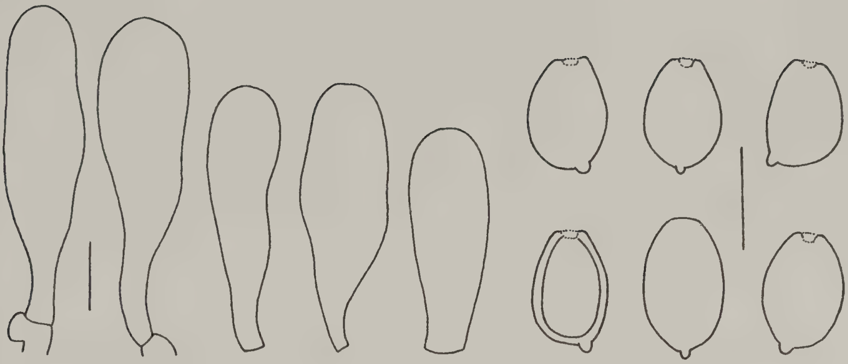

Fig. 1. *Lepiota bohemica* – Spores and cheilocystidia (from lectotype). Bar is 10 µm.

De Kok & Vellinga (1998) disputed the existence of *L. bohemica* on the basis of macroscopical, and microscopical characters, and overlooked that the annulus in this species is simple or slightly double-crowned only. Characters relating to the shape of the squames, the size of the bulb, or the size of the germ pore, do indeed fail to discriminate between *L. bohemica* and *Chl. rachodes*. The shape of the cheilocystidia is the only microscopical character to distinguish the two taxa. Macroscopically, they are reliably discriminated by the annulus and the bulb characters. However, *L. bohemica* is considered here a synonym of *Chl. brunneum* (see below).

Wichansky collected his specimens in a garden.

Collections examined:
Czech Republic, Prague, 'Kinského sady, 10-V-1961, E. Wichansky (Lectotype designated here, PRM); Czech Republic, Pecky, 21-VIII-1964, J. Díte (PRM).

Brunnea – Fig. 2.
Lepiota brunnea Farl. & Burt, Icones farlowianae: 8, pl. 6. 1929; *Macrolepiota rachodes* var. *brunnea* (Farl. & Burt) Candusso in Candusso & Lanzoni, Lepiota s.l., Fungi eur. 4: 535. 1990; *Macrolepiota brunnea* (Farl. & Burt) Wasser, Tribes Cystodermateae Singer and Leucocoprineae Singer of the CIS and Baltic States (Libri botanici 9): 82. 1993; *Chlorophyllum brunneum* (Farl. & Burt) Vellinga in Mycotaxon 83: 416. 2002.

The plate and description of *Lepiota brunnea* (Farlow & Burt, 1929) depict a large mushroom, with a relatively simple annulus, and a bulbous, not marginate, stipe base. The background of the pileus is described as lighter (whitish) than the squames, but is depicted with more or less the same brown colour.

Type collection label information: 'exhibited at Mycological Club, Oct. 1896; Drawing Portf. X 414 were made from this specimen'.

The type collection consists of one basidiocarp, with a bulbous, but not marginate base; an annulus was not found in the material. The following microscopical characters were observed:

Spores [25] 10.0-12.9 x 6.9-8.4 µm, avl x avw = 11.2 x 7.7 µm, Q = 1.29-1.67 avQ = 1.46, ellipsoid-amygdaloid with truncate apex in side view, ellipsoid to ellipsoid-ovoid with truncate apex in frontal view, with broad germ pore, thick-walled, congophilous, dextrinoid, and metachromatic in Cresyl Blue. Basidia 35-40 x 8.0-13

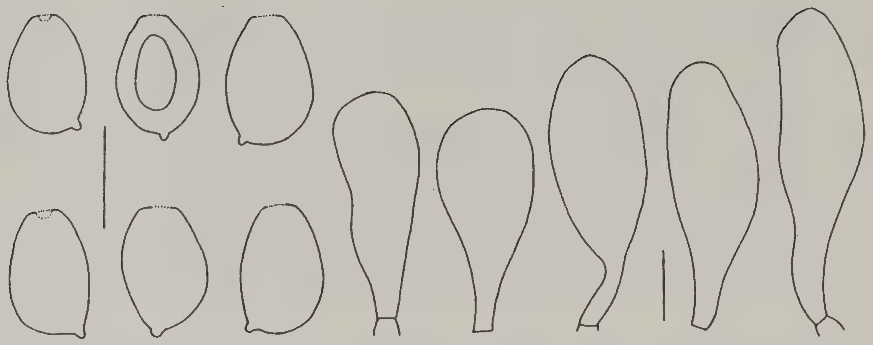

Fig. 2. *Chlorophyllum brunneum* – Spores and cheilocystidia (from holotype). Bar is 10 µm.

µm, 4-spored, some 2-spored. Lamella edge sterile; cheilocystidia 25-48 x 8-19 µm, clavate, more rarely broadly clavate, a few spheropedunculate, with brown contents, brown-walled or colourless. Pleurocystidia not observed. Pileus covering (centre of pileus) made up of tightly packed elements, difficult to observe individually, c. 30-60 x 4-10 µm, cylindrical and with brown content or widened at apex (capitate, clavate) and colourless or brown. Clamp-connections present at base of basidia and cheilocystidia.

A second collection, labeled 'Authentic material', consists of one specimen, with simple ring and bulbous base, and has the following microscopical characters:

Spores [19] 10.6-13.2 x 6.9-8.6 µm, avl x avw = 11.8 x 7.9 µm, Q = 1.38-1.65 avQ = 1.49, ellipsoid-amygdaloid with truncate apex in side-view, ellipsoid with truncate apex in frontal view, with apical wide (up to 3 µm wide) germ pore, thick-walled, congophilous, dextrinoid, metachromatic in Cresyl Blue. Basidia 4-spored, e.g. 40 x 13.5 µm. Lamella edge sterile; cheilocystidia 38-51 x 9-15 µm, clavate and long-stalked, colourless, a few with brown contents. Pleurocystidia not observed. Pileus covering (centre of pileus) made up of tightly packed elements, c. 60-81 x 8-17 µm, cylindrical and flexuous, or widened at apex, most elements with brown contents.

The shape of the cystidia, and the relatively simple annulus are clear indicators that this is the same taxon known as *M. rachodes* var. *hortensis* and *M. bohemica* in Europe and western North America. The only non-conforming character is the stipe base, which is not marginately bulbous. The basidiocarps become totally brown with age.

Lepiota brunnea is the oldest name available for this taxon, and it has been validly published. *Chlorophyllum brunneum* is here accepted as the correct name for the species characterized by a simple annulus, clavate cheilocystidia and spores with a consistently truncate apex and a wide germ pore.

Bon (1993), calling this taxon *M. rhacodes* var. *brunnea*, said it was present in Europe, in *Picea* woods and greenhouses. He erroneously stated that both var. *bohemica* and var. *brunnea* are provided with a double-crowned annulus. The specimens from *Picea* woods he is referring to probably belong to *Chl. olivieri*, as he stated that there is not much colour difference between the squames and the background.

Chlorophyllum brunneum is widespread in North America and Europe, and grows mainly in man-made, nutrient-rich habitats like gardens, and compost heaps. It has also been found in similar habitats in southern Australia (Vellinga, 2003). The type collection was found in a "greenhouse and fertile soil" (Farlow & Burt, 1929).

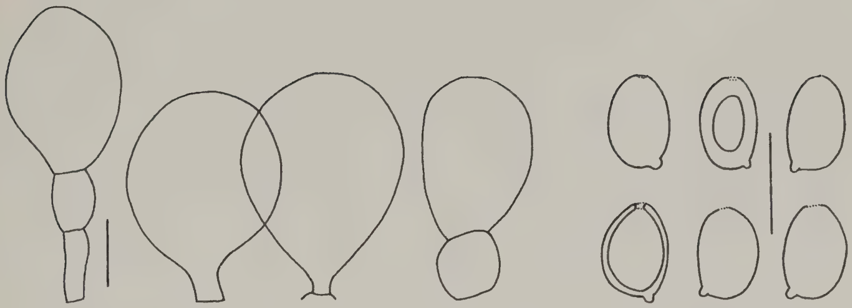

Fig. 3. *Chlorophyllum olivieri* – Spores and cheilocystidia (from coll. E.C. Vellinga 2230 (L)). Bar is 10 µm.

Collections examined:
U.S.A., Massachusetts, Oct. 1
896, collector unknown (holotype, FH); U.S.A., Massachusetts, Cambridge, College Yard, Oct. 1905, Hurlbute (?) (FH).

Hortensis
Lepiota rachodes var. *hortensis* Pilát, Klíc kurcování nasich hub hribovitych a bedlovitych. Agaricales: 422. 1951 (not valid, no Latin description); *Macrolepiota rhacodes* var. *hortensis* (Pilát) Wasser, Flora Grib. Ukr. Agar. Grib.: 298. 1980 (not valid).

Pilát & Usak (1952) gave accurate illustrations of *Lepiota rhacodes* var. *hortensis*, showing a big fleshy fungus, with a marginate bulb, and a relatively simple annulus. Unfortunately, a Latin diagnosis was never provided, so this taxon has not been validly published. Nevertheless, the name *Macrolepiota rachodes* var. *hortensis* has been widely used (e.g. Arora, 1986; Breitenbach & Kränzlin, 1995; Phillips, 1981), but for various taxa (Table I). Arora (1986) and Phillips (1981) used it for a species with a marginate bulbous base, and a relatively simple annulus, matching *L. bohemica* and *Chl. brunneum;* this synonymy is accepted here. Breitenbach & Kränzlin (1995) used it for a species with a bulbous base and a double crowned annulus; their line drawings of microscopical characters show short cheilocystidia and indicate *Chl. rachodes*.

The ecology of *Lepiota rhacodes* var. *hortensis* was given as "In gardens and parks, especially on manured soil rich in humus, on compost and similar places" (Pilát & Usak, 1958), exactly the same habitat as given for *L. bohemica* and *L. brunnea*.

Olivieri – Fig. 3.
Lepiota olivieri Barla in Bull. Soc. mycol. Fr. 2: 113. 1886; *Lepiota rachodes* var. *olivieri* (Barla) Barla, Fl. mycol. ill.: 27. 1889; *Macrolepiota rachodes* f. *olivieri* (Barla) R. de Kok in Kok & Vellinga in Persoonia 17: 74. 1998; *Macrolepiota olivieri* (Barla) Wasser, Fl. Fung. R.S.S. Ucrainicae, Agaricaceae: 298. 1980; *Chlorophyllum olivieri* (Barla) Vellinga in Mycotaxon 83: 416. 2002.

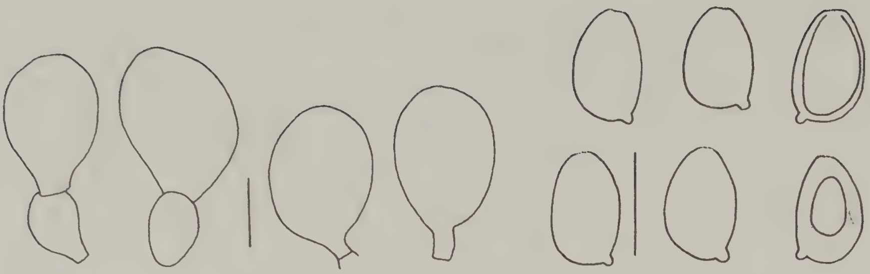

Fig. 4. *Chlorophyllum rachodes* - Spores and cheilocystidia (from coll. E.C. Vellinga 2116 (L)). Bar is 10 µm.

Chlorophyllum olivieri resembles *Chl. rachodes* in general habit, but differs in the olivaceous drab, grey or brownish squames which do not contrast with the background, and the slightly smaller spores, viz. (7.5-)8.0-11.0 x 5.5-7.0 µm, avl x avw = 8.7-10.0 x 5.8-6.6 µm, Q = 1.3-1.65, Qav = 1.45-1.55. This taxon has generally not been recognized and many illustrations of *Chl. rachodes* show this species instead (e.g. Breitenbach & Kränzlin, 1995; Phillips, 1981; see Table I). Comparison of the nrITS sequences of *Chl. rachodes* and *Chl. olivieri* have shown that this is indeed a good species, which is not only morphologically but also molecularly well characterized (Vellinga et al., 2003).

Bellú & Lanzoni (1987) studied Barla's original material, and they did not observe a germ pore in the spores, casting doubt on the right use of the name. For the time being, however, this name is retained for this taxon.

Chlorophyllum olivieri is known from Europe where it is widespread, and from the northwestern part of the U.S.A. It is a species of *Picea* and deciduous woods in Europe, and of oak habitats in the Pacific Northwest.

Rachodes – Fig. 4.
Agaricus rachodes Vittad., Descr. Funghi mang. Italia: 158. 1835; *Agaricus procerus* var. *rachodes* Rab., Deutschl. Krypt.Fl.: 574. 1844; *Lepiota rachodes* (Vittad.) Quél. in Mém. Soc. Émul. Montbéliard. sér. II, 5: 5. 1872 (Champ. Jura Vosges 1); *Leucocoprinus rachodes* (Vittad.) Pat., Ess. tax. Hym.: 171. 1900 (as *L. rhacodes*); *Lepiotophyllum rachodes* (Vittad.) Locq. in Bull. mens. Soc. linn. Lyon 11: 40. 1942 (as *L. rhacodes*); *Macrolepiota rachodes* (Vittad.) Sing. in Lilloa 22: 417. ('1949') 1951; *Chlorophyllum rachodes* (Vittad.) Vellinga in Mycotaxon 83: 416. 2002.

Chlorophyllum rachodes is characterized by big basidiocarps, contrasting squames on the pileus, a double-crowned annulus, a bulbous stipe base (which is not marginate), and spheropedunculate to broadly cheilocystidia, which are 10-35 x 8.5-25 µm and often catenate. Spore sizes are as follows (based on numerous collections from Europe and North America) 8.8-12.7 x 5.4-7.9 µm, avl x avw = 9.5-10.7 x 6.2-7.4 µm, Q = 1.3-1.8(-1.95), avQ = 1.45-1.6; the apex is rounded to truncate with a relatively narrow to broad germ pore.

It is widespread and known from Europe and North America. In western North America it is rare, and there *Chl. brunneum* is the common species. *Chlorophyllum rachodes* grows both in natural and in man-made habitats.

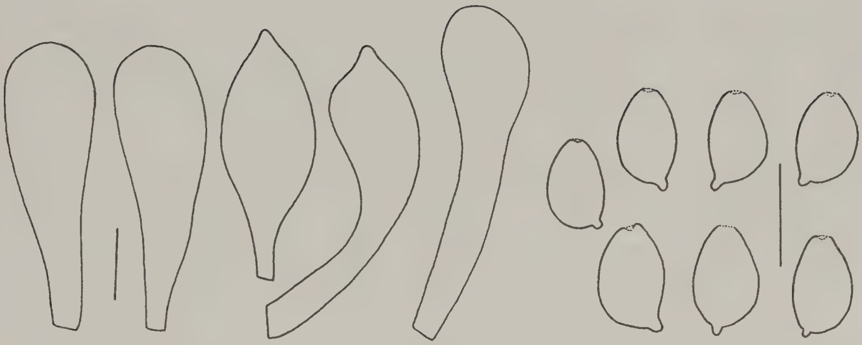

Fig. 5. *Chlorophyllum subrhacodes* – Spores and cheilocystidia (from holotype). Bar is 10 µm.

Subrhacodes – Fig. 5.
Lepiota subrhacodes Murrill in Lloydia 6: 223. 1943; *Chlorophyllum subrhacodes* (Murrill) Vellinga in Mycotaxon 83: 416. 2002.

The type collection consists of one mature and two young basidiocarps, in reasonable condition. The following microscopical characters were observed.

Spores [20] 8.0-9.1 x 5.6-6.2 µm, avl x avw = 8.7 x 5.8 µm, Q = 1.4-1.6, avQ = 1.5, in side-view ellipsoid-amygdaloid with truncate apex, in frontal view ellipsoid-ovoid with truncate apex, with wide apical germ pore, thick-walled, congophilous, dextrinoid and metachromatic in Cresyl Blue. Basidia 27-33 x 8.0-11 µm, 4-spored. Lamella edge sterile. Cheilocystidia 24-55 x 10-17 µm, clavate, some mucronate or with strangulated excrescence, brown-walled. Pileus covering (velar patches) hymeniform, made up of flexuous, cylindrical elements with rounded apex, 22-65 x 5-10 µm, some slightly widened at apex, some with brown intracellular pigment, not as tightly packed as in *Chl. rachodes*. Stipitipellis a cutis of cylindrical straight hyphae, brown coloured, c. 2-6 µm in diameter. Clamp-connections not observed at base of basidia and cheilocystidia.

Spore and cheilocystidial sizes in the other three collections examined are as follows: [50,3,3] 8.1-10.6 x 5.4-9.5 µm, avl x avw = 9.2-9.5 x 5.8-6.0 µm, Q = 1.3-1.75, avQ = 1.55.-1.65; cheilocystidia 19-53 x 8.5-20 µm, very variable in shape, but predominantly clavate.

The type collection of *Lepiota subrhacodes* was examined by Smith (1966). Her observations on spore sizes are in perfect agreement with mine.

Chlorophyllum subrhacodes differs from *Chl. rachodes* in the consistently smaller spores, the clavate cheilocystidia, which sometimes have a moniliform to mucronate excrescence, and the structure of the pileus covering, made up of narrow elements, which are not widened or, rarely, may be slightly widened at apex.

Chlorophyllum subrhacodes is a relatively small species, which resembles *Chl. brunneum*, in habitat and in the clavate cystidia, but differs in the smaller spores with a more tapered apex, and in the fact that some cystidia have a different shape.

It also is close to *Chl. neomastoideum* in the shape and size of the spores, which are slightly smaller in *Chl. neomastoideum* (on average 8.1 x 5.2 µm). The shape of the cheilocystidia is different in *Chl. neomastoideum*, viz. clavate without apical excrescences, and the basidia are provided with clamp-connections.

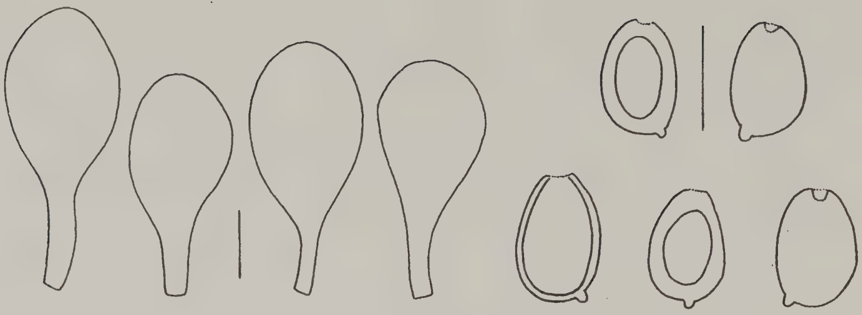

Fig. 6. *Macrolepiota venenata* – Spores and cheilocystidia (from coll. M. Bon 770925 (L)). Bar is 10 µm..

Chlorophyllum subrhacodes has some characters in common with *Leucoagaricus nympharum* (Kalchbr.) Bon, especially the shape of the cheilocystidia, but differs clearly in the shape of the spores, and the structure of the pileus covering, which is much looser in *L. nympharum*. Clamp-connections have not been observed in either species. Shape of the cheilocystidia, and spore size, have turned out to be important characters for species recognition in this group.

Chlorophyllum subrhacodes is only known from Florida, where it is found under oaks in hammocks (Murrill, 1943).

Collections examined:
U.S.A., Florida, Gainesville, Hunter's Station, 26-VII-1938, E. West & W.A. Murrill (holotype, FLAS); U.S.A., Florida, 7-mile Church near Gainesville, Red-oak woods, 27-X-1941, W.A. Murrill, F19494 (FLAS); U.S.A., Florida, Alachua Co., Gainesville, 2-X-1954, E. West, F44267 (FLAS); U.S.A., Florida, Gainesville, campus, 25-IX-1952, W.A. Murrill, F45739 (FLAS).

Venenata – Fig. 6.
Macrolepiota venenata Bon in Bon, Vallée & Jacob in Doc. mycol. 9 (35): 13. 1979 (not valid).

Unfortunately *Macrolepiota venenata* was not validly published. Just as Wichansky had failed to do with *L. bohemica*, Bon (in Bon et al., 1979) omitted to pick one date for his type collection. In the Latin diagnosis only a time of year (Aug. – Nov.) is given, while in the French description the date for the type collection (number 770925) is given as September 1974 to 1977. The author of the species should either make clear on which date the type collection was collected, or designate another collection as the type.

A part of Bon's collection 770925, consisting of a wedge of a pileus, is conserved at L and was studied. The following characters were observed:
Spores [10] 9.7-11.6 x 6.8-8.1 µm, avl x avw = 10.4 x 7.4 µm, Q = 1.3-1.5, avQ = 1.4, ellipsoid-amygdaloid with truncate apex in side-view, ellipsoid-ovoid with truncate apex in frontal view, with broad germ pore and thick wall, congophilous. Basidia 28-37 x 11-15 µm, 4-spored, without clamp-connection at base. Lamella edge sterile;

cheilocystidia 26-35 x 13-15 µm, clavate, without clamp-connection at base. Pileus covering (central patch) made up of tightly packed terminally widened (narrowly clavate), not coloured elements, with narrow cylindrical elements with intracellular brown pigment. Clamp-connections not observed at base of basidia and cystidia.

Macrolepiota venenata was extensively described by Bon et al. (1979), and as stated by these authors, this taxon is characterized by a more radially fibrillose pileus surface than any other species in this group, a relatively simple annulus (a character shared with *Chl. brunneum*), and the absence of clamp-connections at the base of basidia and cystidia. The pileus covering seems to be less tight than in the other taxa, and is easily radially torn apart (Filippi & Barbini, 1989, fig. 2bis; Bon et al., 1979, pl. 4b). On account of the relatively simple annulus and the absence of clamp-connections it was thought to be closely related to *M. excoriata* (Schaeff.: Fr) Wasser, but that species belongs to *Macrolepiota* proper, on account of the trichodermal character of the pileus covering, the presence of bands on the stipe, and the hyaline cap over the germ pore. *Macrolepiota venenata* is apparently toxic (Bon et al., 1979).

It has been reported from nutrient-rich localities in France and Italy.

Collection examined:
France, dépt. Mayenne, Villiers-Charlemagne, La Terrerie, near Laval, Sept. 1974-1977, M. Bon 770925 (L).

Key to the species

1. Spore print green; lamellae completely greenish with age *Chl. molybdites*
1. Spore print white or off-white; lamellae whitish or brownish with age, never totally green; sometimes a bluish green shade is present near the stipe
 2. Pileus squames of similar colour as background (often olivaceous brown, greyish brown); spores (7.5-)8.0-11.0 x 5.5-7.0 µm, avl x avw = 8.7-10.0 x 5.8-6.6 µm *Chl. olivieri*
 2. Pileus squames brown (different shades) on white to cream background, which is distinctly paler than squames (though may become concolorous with age)
  3. Clamp-connections absent at base of basidia and cheilocystidia
   4. Spores 8.0-10.5 x 5.4-6.7 µm, avl x avw = 8.7-9.5 x 5.8-6.0 µm; cheilocystidia 19-53 x 8.5-20 µm, very variable in shape, often clavate, some with moniliform apical excrescence *Chl. subrhacodes*
   4. Spores 9.7-11.6 x 6.8-8.1 µm, avl x avw = 10.4 x 7.4 µm; cheilocystidia 26-35 x 13-15 µm, clavate *M. venenata*
  3. Clamp-connections present at base of basidia and cheilocystidia
   5. Basidiocarps with abruptly to marginately bulbous stipe base; annulus relatively simple, without a double crown, but with a tough brown patch on the underside; spores often with a truncate apex; cheilocystidia 20-51 x 9-19 µm, clavate, narrowly clavate *Chl. brunneum*
   5. Basidiocarps with widened base of stipe, but not abruptly so; annulus complex, with double crown; spores either with truncate or with rounded apex; cheilocystidia 10-38 x 8.5-25 µm long, spheropedunculate, broadly clavate to clavate *Chl. rachodes*

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The curators of the herbaria FH, PRM (Jan Holec) and FLAS (James W. Kimbrough) are acknowledged for the loan of type and authentic collections. John Lennie gave valuable comments on the first draft. Dennis E. Desjardin was so kind as to review the manuscript before publication.

Table I. Overview of the diverse interpretation of names in the group of *Chlorophyllum rachodes*, and the names as accepted in this paper. *Chlorophyllum olivieri* (validly published) and *Macrolepiota venenata* (invalidly published) have always been interpreted in the same way as accepted here.
This overview does not pretend to be complete.

Name[1]	*Status*	*Interpretation*	*Accepted name*
bohemica	invalid	Candusso & Lanzoni, 1990	*brunneum*
		Filippi & Barbini, 1989	*brunneum*
		Lavorato, 1989	*rachodes*
brunnea	valid	Bartelli & Smith, 1964	*rachodes*
		Bon, 1993	probably *olivieri* and *brunneum*
hortensis	invalid	Arora, 1986	*brunneum*
		Bellù, 1982	*brunneum*
		Breitenbach & Kränzlin, 1995	*rachodes*
		Cetto, 1993	*brunneum*
		Phillips, 1981	*brunneum*
		Phillips, 1991	*olivieri* (or *rachodes*)
rachodes	valid	Arora, 1986: pl. 69	*rachodes*
		Bellù, 1982	*olivieri*
		Bon, 1993	*olivieri* (probably)
		Breitenbach & Kränzlin, 1995	*olivieri*
		Cetto, 1980	*olivieri*
		De Kok & Vellinga, 1998	*rachodes* and *brunneum*
		Huffman et al., 1989	*Leucoagaricus americanus*
		Lavorato, 1989	*olivieri*
		Lincoff, 1981	*rachodes* and *brunneum*
		Miller, 1972	*Leucoagaricus americanus*
		Phillips, 1981	*olivieri*

[1] Names as published, and irrespective of rank (both published and interpreted)

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TWO NEW SPECIES OF THE GENUS PHOLIOTA FROM SOUTH INDIA

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Abstract:
Two new species of the genus *Pholiota* viz., *Pholiota sylva* and *Pholiota cystidiata*, collected from Nilgiris district, Tamil Nadu, India, are described.

Key Words: Agaricales, Strophariaceae.

During the course of our studies on South Indian Agaricales two interesting species belonging to the genus *Pholiota* (Fr.) Kummer were collected which are being described as new here. The colour terminology used is that of Kornerup and Wanscher (1978). The specimens are deposited in the herbarium of University of Madras Botany Laboratory (Herb.MUBL). Manjula (1983) in her revised list of Indian agarics listed 12 species of the genus *Pholiota* from India. Natarajan and Raman (1983) have described four species of the genus *Pholiota* which includes one new species *P. truncata* from Tamil Nadu. Agretious Thomas and Manimohan (2001) have described another new species *P. bambusina* from Kerala.

Pholiota sylva Natarajan and C. Ravindran sp. nov. Figs.1-4

Pileus 7-25mm latus, convex ad planus, interdum umbonatus, brunneus, ad marginum brunneolus, siccus, fibrillosus ad squamulosus. Lamellae adnatae, aurantiacus, confertae, latae. Stipe 10-50mm longus, 2-3mm crassus, aurantiacus, aequalis, squamulosus, annuliformis persistens. Spores 5-9 x 3-5 µm, ellipsoideus in fronte, apice cum minuti porus, bene crassitunicata, laevis. Basidia 15-19 x 3.5-7 µm, clavata, 4-sporigera. Pleuro-chrysocystidia 28-40 x 8-11 µm, clavatus ad clavata mucronatus, apice papillatus. Cheilocystidia pleurocystidiis similia. Trama hymenophoralis regularis, tenuitunicata, hyalina. Cuticula pilei ex hyphis radialbus. Hyphis fibulatis. Holotypus: In Herb. MUBL No.3182; lectum prope, Nilgiris, Tamil Nadu, India. 21st July 1998.

Pileus 7-25 mm broad, convex to plane, sometimes umbonate, surface brown (6E6), light brown (6D7) towards the margin, dry, fibrillose to squamulose. Context white. Lamellae adnate, light orange (5A4), close, moderately crowded, broad. Stipe 10-50 x 2-3 mm, surface squamulose, light orange (5A4), equal, annulus persistent, superior. Spores 5-9 x 3-5 (6±0.9 x 3.5±0.2) µm, Q = 1.8, ellipsoid in face view, apex with minute germpore, brown in KOH, thick walled. Basidia 15-19 x 3.5-7 µm, clavate, bearing four sterigmata. Pleurocystidia present as chrysocystidia, 28-40 x 8-11µm, clavate to clavate mucronate, apex papillate or drawn into a distinct projection, with refractive contents hyaline in KOH, dextrinoid in Melzer's reagent, walls thin, smooth. Cheilocystidia similar to pleurocystidia. Hymenophoral trama regular to subparallel, walls thin, hyaline, subhymenium of non-gelatinous, interwoven hyphae, hyaline in KOH. Pileipellis a repent cutis of radially arranged narrow hyphae. Clamp connections present.

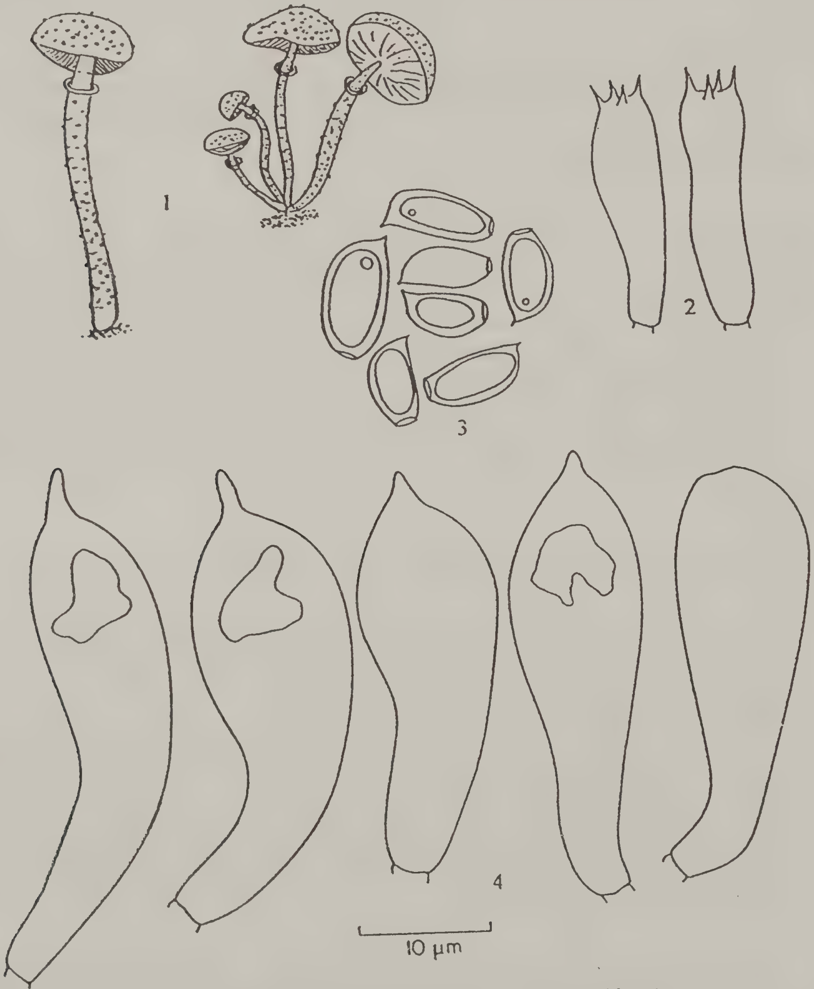

Fig. 1-4. *Pholiota sylva* Natarajan and Ravindran sp. nov. 1. Habit x 1. 2. Basidia. 3. Spores, 4. Pleurocystidia.

On wood and leaf litter, in groups.
Thai shola reserve forest, Manjoor, Nilgiris, Tamil Nadu, India. 21st July 1998. Coll., C.Ravindran, Herb. MUBL No.3182. Type.

Discussion:

The characteristic features of *Pholiota sylva* are the small brown pileus, presence of small brown dotted squamules both in pileus and stipe, light orange stipe, persistant annulus, light orange lamellae, spores with distinct apical germ pore and mucronate chrysocystidia. Presence of scales in both the pileus and stipe and chrysocystidia place this species in the section Pholiota of the subgenus Pholiota (Smith and Hesler, 1968). It comes closer to *P. schraderi* (Peck) Overholts (Smith and Hesler, 1968) in having scales in the pileus and stipe and chrysocystidia, but the presence of smaller pileus, permanent annulus and absence of two types of cystidia differentiate this species from *P. schraderi.*

Pholiota cystidiata Natarajan and C. Ravindran sp. nov. Figs. 5-12

Pileus 10-55mm latus, convexo expansus, postremo planus, interdum cum umbonatus, aurantiacus ad marginum brunneoaurantiacus, siccus, granulosus, margine cum velo remanens. Caro tenuis, flavidus. Lamellae adnatae, latae, confertae, cum lamellulis, margine integra. Stipes 20-60mm longus, 1-2mm crassus, aequalis, cylindraceus, cavus, granulosus, sursum pruinosus, deorsum glabratus. Sporae 6-7.5 x 4-5 µm, suboblongus ad ellipsoideus in frontae, laevis, apice cum minuti porus, bene crassitunicatae. Basidia 19–25 x 3.5-5 µm, cylindrico clavata, 4- sporigera. Cheilocystidia 17.5-22.5 x 3.5-6.5 µm, cylindrico clavata, hyalina, tenuitunicata. Pleurocystidia 25-50 x 6-12.5 µm, clavata ad ventricosa, flavidus. Trama hymenophoralis regularis. Pileus stratum cum catenatus, inflatus ad subglobosus, cellulas 11.5-30 x 11.5-26 µm. Caulocystidia 34-58 x 5.5-8.5 µm, cylindrico ventricosa, brunneus, tenuitunicata. Hyphae omnes fibulatae. Holotypus: In Herb. MUBL No.3183; lectum prope, Nilgiris, Tamil Nadu, India. 9th December 1998.

Pileus 10-55mm broad, convex, expanding, later plane, sometimes with umbo. Surface light orange (5A4), brownish orange (5C4) towards margin, dry, granular, margin with velar remnants, context yellowish. Lamellae adnate, broad, moderately crowded, with lamellulae, edge entire. Stipe 20-60 x 1-2 mm, equal, cylindrical, hollow, surface granular, apex pruinose, glabrescent towards base. Spores 6-7.5 x 4-5 (6±0.4 x 4±0.5) µm, Q= 1.5, suboblong to ellipsoid in face view, brown, with germpore at the apex, thick walled. Basidia 19-25 x 3.5-5µm, clavate, bearing four sterigmata. Pleurocystidia 25-50 x 6.5-12.5 µm, fusoid to ventricose, yellowish to brown homogenous contents in KOH, thick walled. Cheilocystidia 17.5-22.5 x 3.5-6.5 µm, cylindric to sub clavate, hyaline, thin walled. Hymenophoral trama regular. Pileipellis with chains, inflated to subglobose cells 11.5-30 x 11.5-26 µm, radially disarticulating brown cells with incrustation in Melzer's reagent. Hyphae of the context interwoven, with

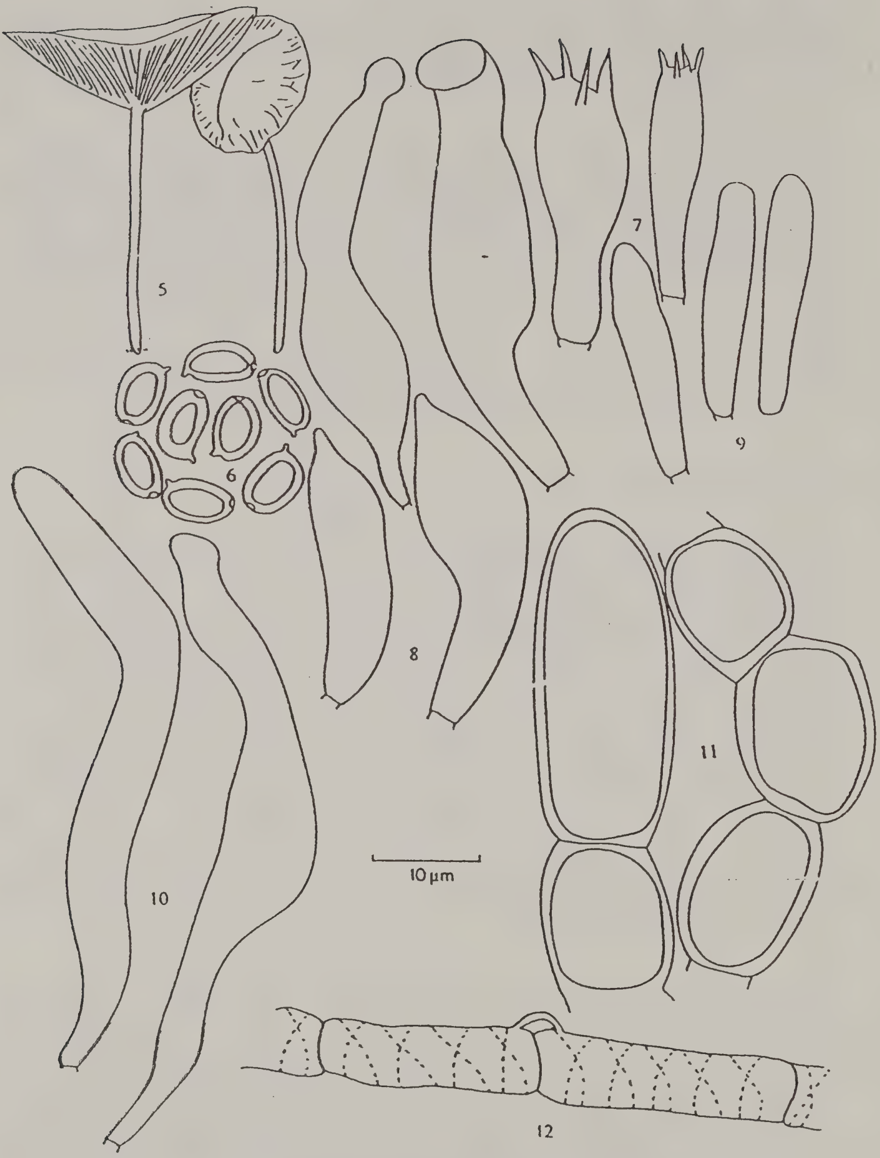

Fig. 5-12 *Pholiota cystidiata* Natarajan and Ravindran sp nov. 5. Habit x 1. 6 Spores, 7 Basidia, 8 Pleurocystidia, 9. Cheilocystidia, 10 Caulocystidia. 11 Pileal surface elements, 12 Pileal hyphae.

incrustation (4-6.5 µm diam.), yellowish to hyaline in Melzer's or KOH. Caulocystidia 34.5-57.5 x 5.5-8.5 µm, cylindric to ventricose, brown pigmented in KOH, thick walled. All hyphae with clamp connections

On soil, scattered.
Naduvattam, Nilgiris, Tamil Nadu, India. 9th December 1998. Coll., C.Ravindran, Herb. MUBL No.3183 (Type).

Discussion:
The characteristic features of *Pholiota cystidiata* are the light orange pileus, spores with germ pore and the presence of both pleurocystidia and cheilocystidia. Pileus with trichodermium of nongelatinous hyphae and with cells more or less inflated or often sphaerocyst like, place the present collection in Section Flavidula of the Subgenus Flavidula (Smith and Hesler, 1968). The present collection resembles *P. erinaceella* (Peck) Peck (Smith and Hesler, 1968) in pileus size, shape, cuticle surface of pileus, but differs in having light orange pileus, spores with germ pore, pleurocystidia and cylindric to clavate cheilocystidia.

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PROTOUSNEA FIBRILLATAE SP. NOV. (PARMELIACEAE, LICHENIZED ASCOMYCOTA) FROM ARGENTINA, SOUTHERN SOUTH AMERICA

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ABSTRACT

Protousnea fibrillatae from south-western Argentinean *Nothofagus* forests, is described as new to science. While the apothecia are typical of *Protousnea*, this new species is characterized by the presence of fibrils, a character previously unknown in the genus. The *meta*-depsides, subsekikaic and 4'-*O*-demethylsekikaic acids are reported the first time for *Protousnea*.

RESUMEN

Protousnea fibrillatae se describe como nueva especie, en base a material proveniente de bosques de *Nothofagus* del sudoeste de la Argentina. Mientras que los apotecios son típicos de *Protousnea*, esta nueva especie se caracteriza por la presencia de fribrillas, un caracter desconocido previamente en este género. Además los meta-depsidos, subsekikaico y 4'-*O*-demethylsekikaico se mencionan por primera vez para *Protousnea*.

Key Words: *Protousnea fibrillatae*, subsekikaic acid, 4'-*O*-demethylsekikaic acid, Patagonia, *Nothofagus* forest.

INTRODUCTION

Protousnea Motyka was originally described as a subgenus of *Usnea* Adans. (Motyka 1936-1938; 1947). Subsequently, Krog (1976) elevated *Protousnea* to generic level, with *P. magellanica* (Motyka) Krog the type species. The genus is characterized by its fruticose, generally pendulous thallus, which usually lacks papillae, pseudocyphellae, fibrils, spinules or soredia; apothecia without fibrils on the thalline exciple, with brown and glossy disc; and by the presence of depsides as medullary substances with divaricatic acid and related satellite substances being most common. The distribution of *Protousnea* is restricted to south-western South America and the Islas Malvinas (Krog, 1976). Seven species were considered in Krog`s treatise, all of which have been reported from Argentina (Calvelo & Liberatore, 2002), including: *Protousnea alectoroides* (Motyka) Krog, *P. dusenii* (Du Rietz) Krog, *P. magellanica* (Mont.) Krog, *P. malacea* (Stirt.) Krog, *P. poeppigii* (Nees & Flot.) Krog, *P. scrobiculata* (Sambo) Krog and *P. teretiuscula* Krog. The genus *Protousnea* was considered to belong to the family Usneaceae by Hale (1983), but has been included in the Parmeliaceae by other authors (Henssen & Jahns, 1974; Tehler, 1996).

During the past 25 years no floristic or taxonomic novelties have been reported for this genus. However, a key to the species was published as part of a key to the Parmeliaceae from the Argentinean Patagonia (Calvelo, 1998). In addition, *Protousnea* was briefly mentioned when evolutionary trends in the Parmeliaceae (Krog, 1982) were considered and several other contributions dealt with aspects of secondary chemistry (Kinoshista et al., 1994a; 1994b). The use of *P. magellanica* as a bioindicator in both *in situ* (Bubach et al., 1998; Calvelo *et al.*, 1997) and in thallus transplantation experiments (Calvelo *et al.*, 2002) has also been described.

The present contribution is part of a comprehensive revision of the genus *Protousnea*, based on the personal collections of Calvelo and Liberatore and studies of herbarium material from BAFC, BCRU, MSC, S and UPS. The new species, *Protousnea fibrillatae* is described and the depsides subsekikaic and 4'-*O*-demethylsekikaic acids are reported the first time for the genus *Protousnea*.

MATERIALS and METHODS

The collections for the present study were made in a southern South America *Nothofagus pumilio* (Poepp. et Endl.) Krasser deciduous forest (41° S, 71° W) and are deposited at BCRU and Calvelo's personal herbarium (Herb. Calvelo). For comparison purposes, specimens from BAFC, BCRU, MSC, UPS and S have also been studied, including type specimens of all *Protousnea* species.

The morphology and anatomy of specimens were studied under a light microscope (MO) and a scanning electron microscope (SEM). Photographs were taken under an Olympus SZ4045-TRPT dissecting microscope connected to an Olympus C-3000 digital camera or digitalized from SEM microscope images. Lichen substances were identified by thin layer chromatography (TLC) and high performance liquid chromatography (HPLC).

HPLC analyses and identification of the depsides

Natural compounds were characterized by high-performance liquid chromatography (HPLC) using both a Hewlett-Packard and a Merck/Hitachi Spectra system, a Phenomenex Hypersil and a Beckman column 5C18 (250 by 4.6 mm) and spectrometric detectors operating at 254 nm with a flow rate of 1 ml/min were used. Retention index values (R_I) calculated using benzoic acid and solorinic acid with controls (Elix & Wardlaw 2000; Feige *et al.* 1993). Two solvent systems were used: 1% aqueous orthophosphoric acid and methanol in the ratio 7:3 (A) and methanol (B). The run started with 100% A and was raised to 58% B within 15 min, then to 100% B within a further 15 min, followed by isocratic elution in 100% B for a further 10 min. Both HPLCs were coupled to a photodiode array detector for ultraviolet spectroscopic comparisons. By this means the ultraviolet spectra observed for the various components eluting in the HPLC chromatogram were recorded and computer-matched against a library of ultraviolet spectra recorded for authentic metabolites under identical conditions. For all depsides the correlation of ultraviolet spectra of the authentic and natural material was greater than 99.9%. The quantitative determination of the respective lichen substances was effected by using the detector responses in the HPLC chromatograms, where the integrated areas under the particular peaks reflect the concentration of the substances present.

Names of the herbaria are reported according to Holmgrem and Holmgrem (2001). Authors of plants names are reported as described in Brummitt & Powell (1992).

Protousnea fibrillatae Calvelo, Stocker-Wörgötter, Liberatore & Elix

Holotypus: Argentina, Provincia de Río Negro, Departamento Bariloche, Cerro Otto, north slope, on *Nothofagus pumilio*, 1300 m above sea level, 4 Oct. 2001, S.Calvelo & S.Liberatore (BCRU 04340). Isotypus Herbarium Calvelo (1112).

Thallus corticolus, pendules, usque ad 50 cm longus, rigidus, non dichotome ramosus, simpodial. Vulgo sat crebre transversim rupti. Fibrils numerosa, terete, intertextus. Isidia et soralia desunt. Apothecia usque ad 2.5 mm diametro, disco castaneo, nitido. Pycnidia numerosa, conidia filiform 9-12 x 1 µm. Sustantiae lichenum: acida

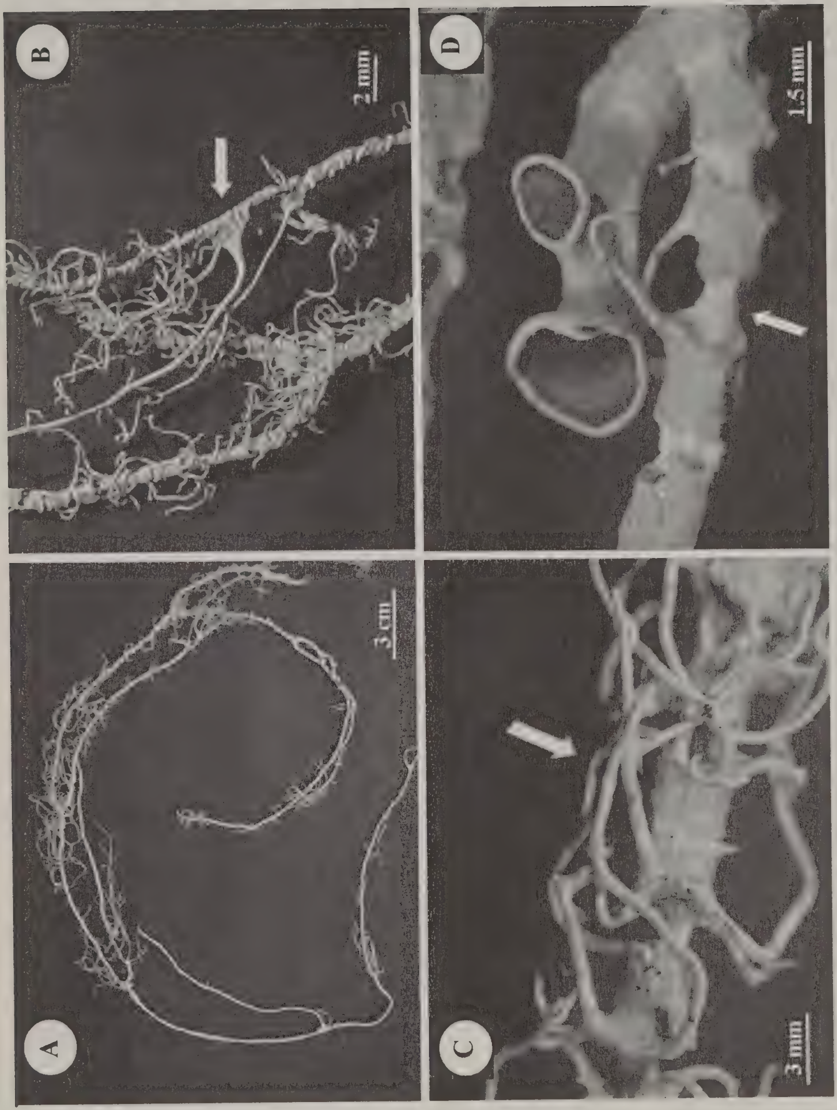
B
2 mm
D
1.5 mm
A
3 cm
C
3 mm

Fig. 1 – *Protousnea fibrillatae.* A – thallus. B – flattened branching points (arrow). C – fibrils; gaps (arrow). D – apothecia: gaps (arrow).

usnicum, divaricaticum, subdivaricaticum, sekikaicum, subsekikaicum et 4'-*O*-demethylsekikaicum adsunt.

Thallus corticolous, pendulous, up to 50 cm long, rigid, sympodial (Fig. 1A). Upper surface matt, stramineous. Main branches terete; flattened at branching points (Fig. 1B); up to 2.5 mm diam.; non foveate; without isidia and soredia; homogeneously vertebrate all along their length (Fig. 1C). Vertebrae formed by breaks in the continuity of cortex, algal layer and medulla, exposing the central axis: gaps (Fig. 1D). With numerous terete, twining fibrils, up to 0.5 mm diam., branched, with blackened tips, growing mostly from margins of thallus vertebrae (Fig. 1C; 2D). Cortex smooth (Fig. 2A), 25-50 µm; algal layer 40-50 µm; medulla dense 150 - 400 µm; central axis occupying less than half of the width of the branch, 300 - 700 µm (Fig, 2B; 2C). Apothecia on main branches, to 2.5 mm diam., thalline excipule smooth, thin; disc brown, glossy (Fig. 1D). Asci 8-spored; ascospores unicellular, hyaline, ellipsoid, 4 - 5 x 6 - 9 µm. Pycnida immersed on thallus, black, spherical, 40 - 60 µm diam. Conidia filiform 10 - 16 x 1 µm.

Chemistry: Upper cortex K- (usnic acid). Medulla K-, C- (divaricatic, subdivaricatic, sekikaic, subsekikaic and 4'-*O*-demethylsekikaic acids) (Fig. 3).

Additional specimens examined: Argentina, Provincia de Río Negro, Departamento Bariloche, Cerro Otto, north slope, on *Nothofagus pumilio*, 1420 m above sea level, 28 February 2002, S.Liberatore & S. Calvelo. Herbarium Calvelo (2097).

REMARKS

In the present context fibrils are considered to be short, branch-like appendages, with a central axis that is not attached to the central axis of the branch from which the fibril grows (Clerc, 1998). The main distinguishing feature of *Protousnea fibrillatae* is the presence of such fibrils. This is the first time such appendages have been observed in the genus *Protousnea*, previously having being considered typical of the genus *Usnea*. Other particular features of the new species are the sympodial branching, the homogeneously

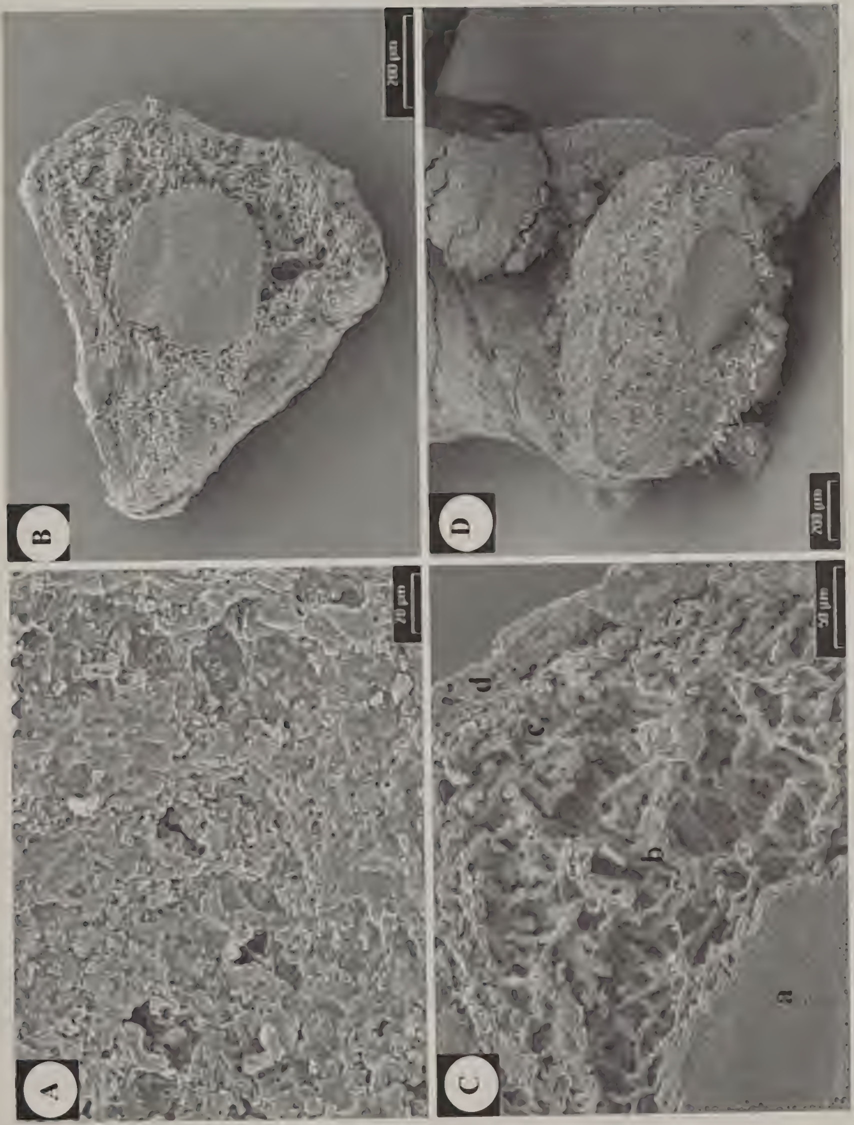
B
200 µm
D
200 µm
A
20 µm
C
50 µm
a
b
c
d

Fig. 2 – *Protousnea fibrillatae*. A – cortex. B – transverse section. C – a: central axis, c: algal layer, d: cortex. D – fibrils.

vertebrate thallus with fibrils arising from the margins of the vertebrae forming a crown-like structure around the gaps.

It is also noteworthy that beside the major secondary substance sekikaic acid, additional minor quantities of the related *meta*-depsides subsekikaic and 4'-*O*-demethylsekikaic acids were detected by HPLC analyses (Fig. 3) and are reported for the first time for the genus *Protousnea*.

ACKNOWLEDGEMENTS

Field surveys, morphological and anatomical studies were conducted at the Centro Regional Universitario Bariloche (Universidad Nacional del Comahue) and were supported by Agencia de Promoción Científica y Tecnológica (Project PICT99 13-07114); the chemical analyses were partly conducted at the Institute of Plant Physiology (University of Salzburg) and at the Department of Chemistry (Australian National University). The chemical study was generously supported by a grant, 15328-BIO, of the Austrian Science Foundation (FWF) to E. ST-W.

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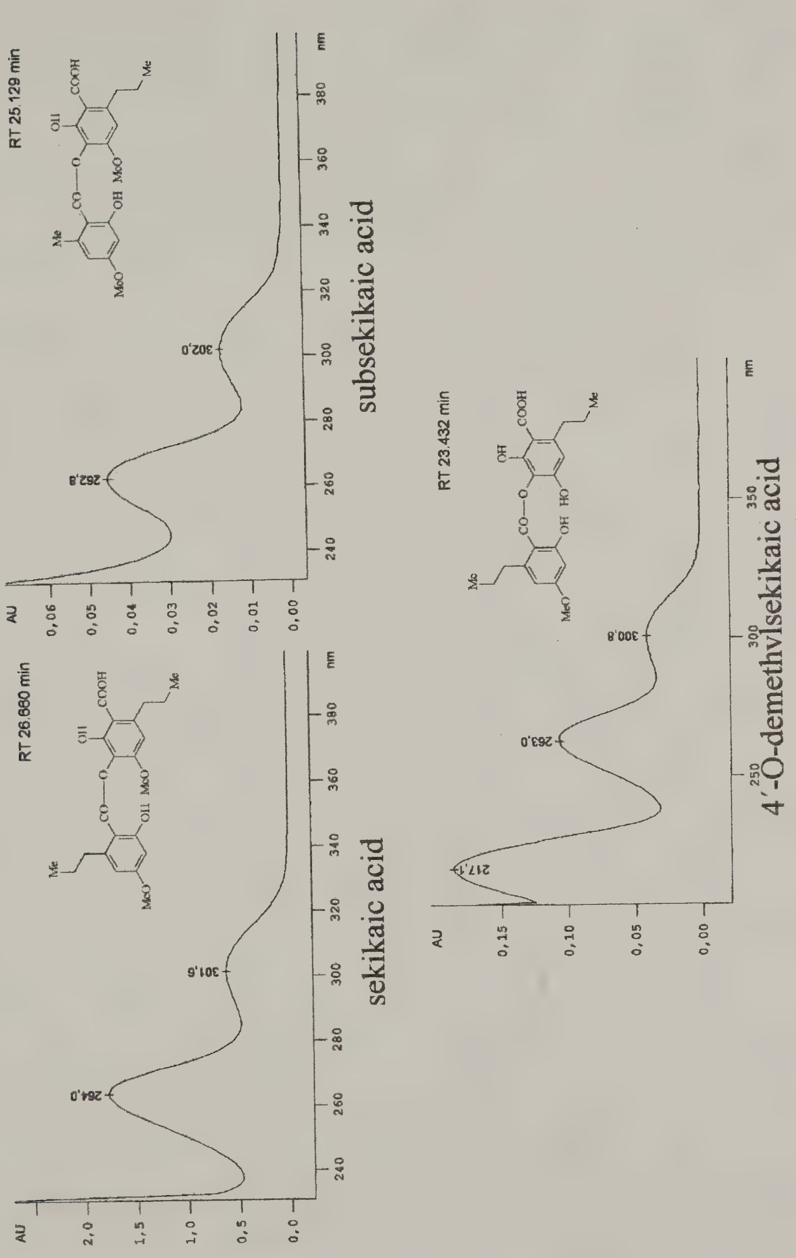

sekikaic acid

subsekikaic acid

4′-O-demethylsekikaic acid

Fig. 3- *Protousnea fribrillatae.* Chemistry (showing the repective structure and UV spectra of the *meta*-depside components).

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NEW TAXA IN THE LICHEN GENUS PERTUSARIA (LICHENIZED ASCOMYCOTINA) FROM THAILAND

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ABSTRACT: *Pertusaria alboaspera* var. *deficiens*, *P. hylocola, P. litchicola* and *P. subplanaica* var. *tetraspora* from Thailand are reported as new to science.

KEY WORDS: *Pertusaria alboaspera* var. *deficiens*, *P. hylocola*, *P. litchicola*, *P. subplanaica* var. *tetraspora*, depside methyl ester, methyl 2-*O*-methyldivaricatate

INTRODUCTION

The first species of *Pertusaria* to be described from Thailand was *P. pustulata* (Ach.) Duby (Wolseley *et al.* 2002). Since the publications of E. Vainio in 1907, 1909 and 1921 (Alava 1988), two new species of this genus have been reported from Thailand, *P. nahaeoensis* from Nahaeo National Park and *P. omkoiensis* from Omkoi Sanctuary (Jariangprasert *et al.* 2002). Additional Thai taxa have now been discovered and are here described as new to science.

MATERIALS AND METHODS

This report is based on specimens housed in RAMK (Lichen Research Unit, Ramkhamhaeng University, Bangkok), CMU (Chiang Mai University Herbarium) and recent collections made by one of us (SJ) from several national parks in Thailand. The techniques used for thin layer and high performance liquid chromatography follow standard methods (Elix & Ernst-Russell 1993; Feige *et al.* 1993).

THE NEW TAXA

Pertusaria alboaspera var. deficiens Jariangprasert & A. W. Archer, var. nov. Fig. 1

Similis *Pertusaria alboaspera* var. *alboaspera* sed acidum sticticum deficiens.

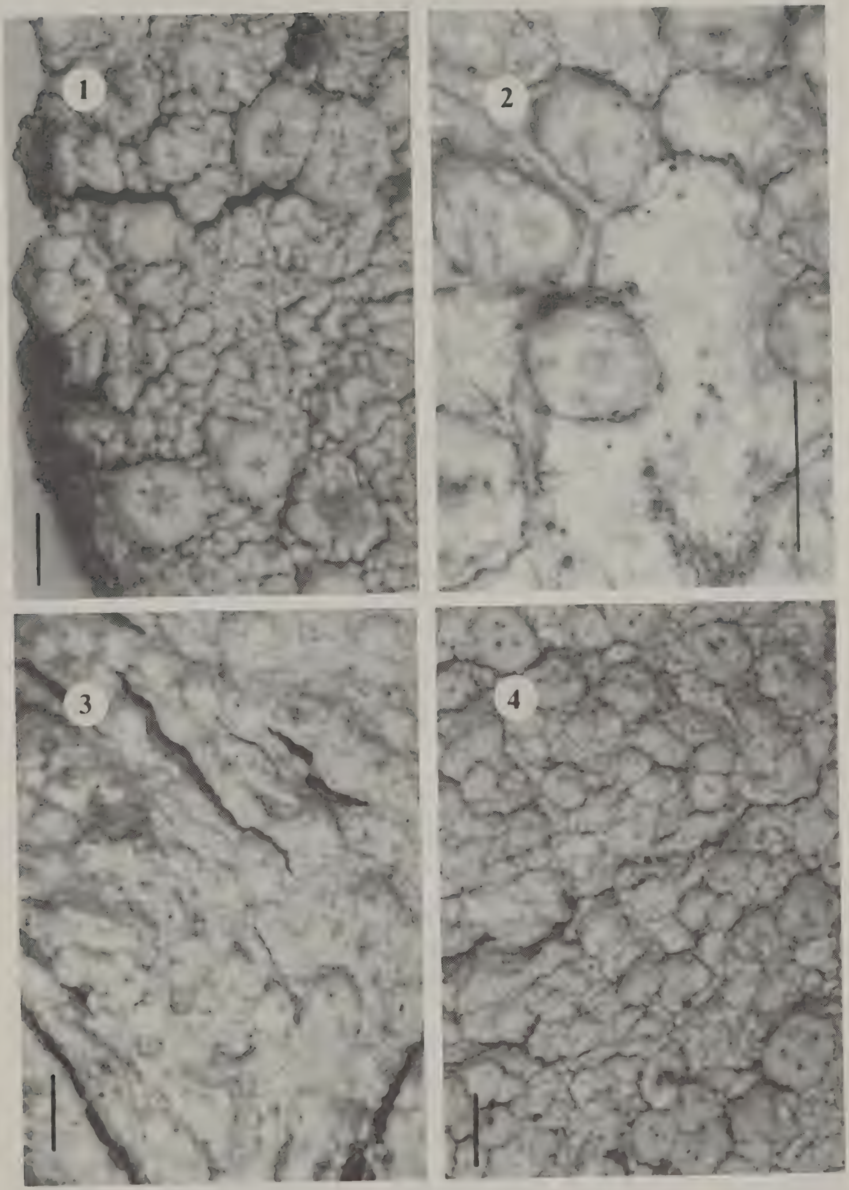
Type: THAILAND. Chiang Mai Province, Mae Rim District, The Queen Sirikit Botanic Garden, close to a Leguminosae-Papilionoideae plot near the Headquarters, 18°46'N, 98°50'E, 800 m, on bark of *Castanopsis costata* Miq., *K. Boonpragob s.n.,* 26 Jan. 1994; holotype RU 713 (RAMK).

Thallus corticolous, greyish green, smooth, dull, areolate and subtuberculate, isidia and soredia absent. *Apothecia* verruciform, numerous, conspicuous, crowded, not confluent, constricted at base, concolorous with the thallus, round and flattened-hemispherical, concave to protruding when mature, 0.3-0.6 mm diam. with solitary ostiole, 0.6-1.1 mm diam. with multiple ostioles. *Ostioles* variable, inconspicuous, pale yellowish and slightly raised or conspicuous, black and slightly depressed, rarely fused, 0.05-0.10 mm diam., 1-4(-5) per verruca. *Ascospores* 8 per ascus, basally irregularly biseriate to biseriate, ellipsoid to subfusiform, (48-) 64-78 (-92) μm long, 28-38 μm wide, smooth; outer spore wall 4-8 μm thick.

Chemistry: K+pale yellow, KC-, C-, Pd-, UV+yellow; lichexanthone (major), 2,2'-di-*O*-methylstenosporic acid (major), 2'-*O*- methylstenosporic acid (minor).

Distribution and ecology: *Pertusaria alboaspera* var. *deficiens* is an endemic corticolous variety from The Queen Sirikit Botanic Garden in dipterocarpous forest at an elevation of 800 m.

Remarks: *Pertusaria alboaspera* var. *deficiens* is characterised by verruciform apothecia, asci with 8 biseriate ascospores and the presence of lichexanthone, 2,2'-di-*O*-methylstenosporic acid and 2'-*O*-methylstenosporic acid. It resembles *P. alboaspera* A. W. Archer & Elix var. *alboaspera* (Archer & Elix 1993) from eastern Australia but that variety has inconspicuous, pale, translucent ostioles in contrast to the ostioles in *P. alboaspera* var. *deficiens* which become black when mature. In addition *P. alboaspera* var. *deficiens* lacks stictic and constictic acids (present in var. *alboaspera*) and also contains 2'-*O*-methylstenosporic acid, absent from var. *alboaspera.* The absence of stictic acid in the new variety distinguishes it from the chemically and morphologically similar *P. verruculifera* Vain. from Brazil (Vainio 1890), and *P. congesta* Vain. [syn.: *P. glaucocinera* Vain.] from Angola (Vainio 1901).



Figures 1-4. New taxa of *Pertusaria*. 1. *P. alboaspera* var. *deficiens* (holotype in RAMK); 2. *P. hylocola* (holotype in RAMK); 3. *P. litchicola* (*D. Allen*, CMU 166); 4. *P. subplanaica* var. *tetraspora* (holotype in RAMK). Scale bar = 1.0 mm

Additional specimens examined: THAILAND. Type locality, on bark of *Castanopsis costata* Miq., *K. Boonpragob s.n.,* 26.i.1994, RU 711 (RAMK); *ibid.*, on trunk of *Peltophorum pterocarpum* Back., *K. Boonpragob s.n.,* 26.i.1994, RU 130 (RAMK).

Pertusaria hylocola Jariangprasert & A. W. Archer, sp. nov. Fig. 2

Similis *Pertusaria injuneana* sed acidum hyperlatolicum et sticticum continens.

Type: THAILAND. Nan Province, Bo Kluea District, Bo Kluea Nhuea Community, right wayside before the fourteenth kilometre stone from Bo Kluea Nhuea to Bo Kleua District, 1000 m, on fallen log, *S. Jariangprasert 1612*, 9 June 2001; holotype: RAMK.

Thallus corticolous, yellowish, continuous, surface smooth and slightly shiny, isidia and soredia absent. *Apothecia* verruciform, conspicuous, scattered, not confluent, hemispherical, 0.3-0.85 mm diam. *Ostioles* conspicuous, translucent, yellowish to grey, slightly raised, surrounded with yellowish translucent tissue, 1 per verruca. *Ascospores* (3-) 6 (-8) per ascus, uniseriate to irregularly uniseriate (basally biseriate), occasionally biseriate, ellipsoid, 64-89 μm long, 28-42 μm wide, smooth; outer ascospore wall 6-10 μm thick.

Chemistry: K+ yellow, KC+ yellow-orange, C+ yellow-orange, Pd+ orange, UV+ bright orange; stictic acid (major), constictic acid (major), perlatolic acid (minor), hyperlatolic acid (minor), thiophaninic acid (minor), cryptostictic acid (trace), peristictic acid (trace), methyl stictic acid (trace), methyl pseudolusitanate (trace), 2-chloro-6-*O*-methylnorlichexanthone (trace).

Distribution and ecology: *Pertusaria hylocola* is a rare, endemic, corticolous species known only from the type specimen.

Remarks: *Pertusaria hylocola* is characterised by verruciform apothecia, asci with (3-) 6 (-8) ascospores and the presence of thiophaninic, stictic, perlatolic and hyperlatolic acids. The combination of thiophaninic and stictic acids is common in the genus *Pertusaria,* but the combination of thiophaninic and stictic acids with an orcinol depside is rare and has only been reported from *P. paradoxica* A. W. Archer & Elix (Archer 1997). *Pertusaria hylocola* resembles *P. injuneana* A.W. Archer & Elix; both species have asci with eight ascospores and contain thiophaninic and perlatolic acids but *P. hylocola* differs in containing additional stictic and hyperlatolic acids.
The epithet *hylocola* is from the Greek *hylo* (wood) and the Latin suffix *cola* (dweller) a reference to the substrate of the holotype.

Pertusaria litchicola Jariangprasert & A. W. Archer, sp. nov. Fig. 3

Similis *Pertusaria velloziae* sed ascosporis parietibus interius undulatis et materia chemica aliter.

Type: THAILAND. Chiang Mai Province, Mhoo 4 Ban Chang Kian, Doi Suthep-Pui National Park, 18°50'N, 98°50'E, 1340 m, in woodpile of hill tribe, on bark of *Litchi chinensis* Sonn., *S. Jariangprasert 1662*, 16 June 2001; holotype: RAMK.

Thallus corticolous, yellowish ivory to greyish green, surface smooth and dull, slightly rugose, isidia and soredia absent. *Apothecia* conspicuous, verruciform, scattered, rarely confluent, concolorous with the thallus, constricted at the base, round to oblong, sometimes flattened, surface margin of apothecia granulose, 0.3-0.95 mm diam. *Ostioles* inconspicuous, translucent, yellowish to grey, sometimes becoming mammiform, 1-2 per verruca. *Ascospores* 2 rarely 3 per ascus, arranged longitudinally, ellipsoid to cylindrical, 86-150 μm long, 26-44 μm wide, rough; outer ascospore wall 5-12 μm thick.

Chemistry: K- or K+ pale yellow, KC-, C-, Pd-, UV+ orange-red; methyl 2-*O*-methyldivaricatate (major), 2-*O*-methyldivaricatic acid (major to minor), 4,5-dichlorolichexanthone (minor to trace).

Distribution and ecology: *Pertusaria litchicola* is a corticolous species, found in the north and north-east of Thailand, in evergreen hill forest and mixed Fagaceae/deciduous forest, and also in a lychee orchard, at elevations of 870 to 1340 m.

Remarks: *Pertusaria litchicola* is distinguished from other *Pertusaria* species with two rough ascospores by its chemistry, in particular the presence of methyl 2-*O*-methyldivaricatate as a major compound. Esters of orcinol depsides are rare in the genus *Pertusaria*, although the β-orcinol depside atranorin is found in many lichen genera and occurs sporadically in *Pertusaria.* Methyl 2-*O*-methyldivaricatate occurs as a trace compound in *P. orarensis* A. W. Archer & Elix (Archer 1997), but the occurrence of an orcinol depside methyl ester as a major lichen compound has not been previously reported. *Pertusaria litchicola* resembles *P. velloziae* (Vain.) Erichs., but the spore walls in *P. litchicola* are rough in contrast to the smooth spore walls in *P. velloziae*. Both species contain divaricatic acid derivatives: 2'-*O*-methyldivaricatic acid in *P. velloziae* and the methyl ester of the isomeric 2-*O*-methyldivaricatic acid in *P. litchicola.*
The epithet *litchicola* is derived from the Latin *litchi* (lychee) and *cola* (dweller) in reference to the substrate of the holotype.

Additional specimens examined: THAILAND. Loei Province, Nahaeo District, Nahaeo National Park, 1 km along the way to observation post unit 1, alt. 870 m, on bark of *Schima wallichii* Korth in evergreen hill forest, *N. Homchantara s. n.*, 13.vii.1995, RU 5528 (RAMK); Chiang Mai Province, Chiang Dao District, 1 km SE of Kun Maengai RFD camp (Khun Mae Gog Unit), Grid MS 8256, 1100 m, in mixed Fagaceae/deciduous forest, *D. Allen*, 22.x.1995 (CMU 166).

Pertusaria subplanaica var. **tetraspora** Jariangprasert & A.W. Archer, var. nov. Fig. 4

Similis *Pertusaria subplanaica* sed ascis tetrasporis differt.

Type: THAILAND. Chiang Mai Province, San Sai District, Ban Pa Phai Community, Banpong Forest, 18°53'N, 98°59'E, 300 m, on bark of *Dipterocarpus obtusifolius* Teijsm ex Mq. in *Dipterocarpus* forest with sandstone, *S. Jariangprasert 866*, 17 July 2000; holotype: RAMK.

Thallus corticolous, greyish ivory, surface rugose and irregularly tuberculate, isidia and soredia absent. *Apothecia* verruciform, conspicuous, scattered, rarely confluent, concolorous with thallus, flattened-hemispherical or irregular, mostly constricted at the base, 0.7-1.0(-1.5) mm diam. *Ostioles* inconspicuous, translucent and stellate-punctiform when young, conspicuous and grey when old, some fused in the centre, flat or slightly depressed, 1-5 per verruca, 0.06-0.12 mm diam. *Ascospores* 2-3(-4) per ascus, uniseriate, slightly overlapping, ellipsoid to subfusiform, 84-142 μm long, 36-54 μm wide, smooth, laminated; outer ascospore wall 8-16 μm thick.

Chemistry: K+ yellow, KC-, C-, Pd-, UV+ orange; 2,2'-di-*O*-methylstenosporic acid (major), 2'-*O*-methylstenosporic acid (minor), planaic acid (minor), 4,5-dichlorolichexanthone (minor).

Distribution and ecology: *Pertusaria subplanaica* var. *tetraspora* is a rare, endemic, corticolous lichen known only from the type specimen from Banpong forest.

Remarks: The morphology and chemistry of *Pertusaria subplanaica* var. *tetraspora* is virtually identical to that of *P. subplanaica* A. W. Archer & Elix var. *subplanaica* (Archer & Elix 1992) but the two varieties differ in the number of ascospores per ascus: 8 in var. *subplanaica* and 2-4 in var. *tetraspora.*

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A NEW SPECIES AND NEW RECORDS OF GYMNOPILUS FROM INDIA

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ABSTRACT

A new terrestrial species of *Gymnopilus*, *G. terricola,* is proposed. *G. bryophilus*, previously known only from Jamaica, is recorded for first time from India, and *G. dilepis* is recorded from a new locality.

Key words: Basidiomycota, Agaricales, Cortinariaceae, *Gymnopilus bryophilus, G. dilepis, G. terricola* sp. nov.

INTRODUCTION

The genus *Gymnopilus* has been studied in India by Natarajan & Raman (1983); they considered eight species. Other authors who have recorded species of this genus from India are Saccardo (1887) (as *Flammula*), Natarajan (1977), Dhancholia et al. (1991) and Abraham (1994). In this paper, *G. terricola*, a new species; *G. bryophilus,* a new record for the country; and *G. dilepis*, a new record for tropical India, are described and illustrated.

Microscopical observations were made from material mounted in 3% KOH, Melzer's reagent and cresyl blue. Spore shape was determined based on Q (length-width ratio) of 20 basidiospores. Spore measurements include ornamentation but not the apiculus. For macrochemichal reaction KOH 5% was used. The color codes used in the description of species are from Kornerup & Wanscher (1978). The herbarium name abbreviations follow Holmgren et al. (1990).

TAXONOMY

Key to the species

1. Stipe eccentric in adult specimens … … … … … … … … … … …***Gymnopilus bryophilus***
1. Stipe central … 2
2. Basidioma terrestrial; pileus less than 20 mm broad … … … …***Gymnopilus terricola***
2. Basidioma lignicolous; pileus more than 20 mm broad … … … … … … … … ***G. dilepis***

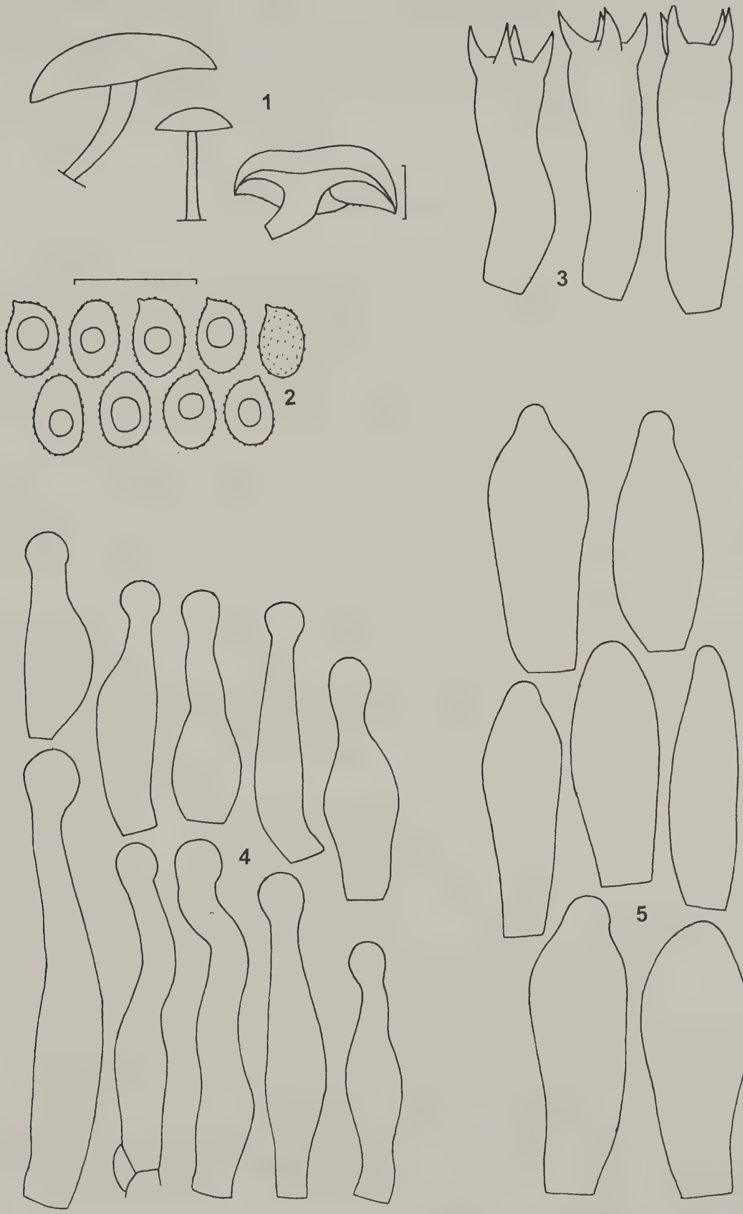
Gymnopilus bryophilus Murrill, Mycologia 5: 22 – 23, 1913.
Fig. 1 – 5

Pileus 15–55 mm diam., convex to plano-convex; surface orange (5A7-6A7), fading to light orange (5A6), velutinous or finely floccose especially in the disk when young, then appressed-fibrillose or punctate-squamulose, dry; margin incurved to decurved, entire to lobate. Context up to 5 mm thick at the centre, white with a yellow tint. Lamellae adnate to sinuate, light orange to orange (5A6, 5A7), crowded to subcrowded, ventricose, up to 5 mm wide, with lamellulae of different lengths; edge concolorous with the sides, eroded. Stipe 15–35 x 3–8 mm, central becoming eccentric with age, in some specimens almost lateral, terete, equal or tapering basally, solid; surface whitish to light orange (5A4, 5A5), not staining when bruised, fibrillose; base with scarce whitish mycelium. Veil arachnoid, evanescent. Odour not distinctive. Spore-print orange (5A7). Pileus and stipe surfaces darken to reddish-black with aqueous KOH on dry basidiomata.

Basidiospores 5.2 – 7.2 (– 7.6) x 4 – 4.8 (– 5.2) µm, Q = 1.18–1.55 (– 1.66), broadly ellipsoid to ellipsoid, occasionally subamygdaliform, with obtuse or subacute apex, subthick-walled, with fine verrucose ornamentation, without plage, without a germ-pore, yellowish-brown or orange-brown, dextrinoid, not metachromatic. Basidia 21.5 – 30.4 x 5 – 6.4 µm, cylindric-clavate to clavate, with or without central constriction, sometimes with yellowish-brown content, 4-spored; sterigmata up to 6.4 µm long. Pseudocystidia 16.5–31.2 x 5.5–10 µm, utriform, clavate with subacute or widely mucronate apex, thin-walled, with yellowish or orange-brown content, numerous, originating from hymenophoral tramal hyphae below the subhymenium or at the same level as the basidia. Lamella-edge sterile with crowded cheilocystidia. Cheilocystidia 15–37.5 x 3.5–7.6 µm, apex 3.2-4.8 µm wide, tibiiform, narrowly utriform or almost lecythiform, thin-walled, hyaline or with yellowish or yellowish-brown content. Hymenophoral trama subregular; hyphae 2–24 µm wide, thin- to subthick-walled, yellowish to light yellowish brown. Subhymenium ramose. Pileal trama radial; hyphae 2–22.5 µm wide, thin- to subthick-walled, hyaline to pale yellow. Pileipellis a cutis, occasionally disrupted by small ascending hyphal clusters; hyphae 2–12.8 µm wide, thin to subthick-walled, encrusted in bands with a yellow or orange-brown pigment. Stipe trama parallel; hyphae 2–21.5 µm wide, thin- to slightly thick-walled, yellow. Stipitipellis a cutis; hyphae 1.5–7.5 µm wide, thin-walled, encrusted with a yellow pigment. Caulocystidia 19.2-82.4 x 2.8-7.2 µm, apex 4-6.8 µm wide, cylindric, cylindric-flexuose, or cylindric-ventricose, with obtuse, subcapitate, capitate or rostrate apex, hyaline, with yellow content, thin- to subthick-walled, in tufts at the stipe apex, less differentiated but present at the middle and base of stipe. Clamp-connexions present in all parts of the basidioma. A yellowish pigment dissolves when lamellae are mounted in KOH.

On a decaying wood, gregarious, October.

Specimens examined: India, Kerala State, Wayanad District, Ponkuzhy: 1 October 1997, A. Thomas T177 (IBUG); 3 October 1997, A. Thomas T177b (IBUG).
Additional material examined: Jamaica, Port Antonio, on decayed mossy log, November 24, 1902, *F. S. Earle 613* (NY, Type).



Figs. 1–5. *Gymnopilus bryophilus*, 1: basidiomata, 2: basidiospores, 3: basidia, 4: cheilocystidia, 5: pseudocystidia. Scale bar = 10 mm for basidiomata and 10 µm for microstructures.

The Indian collections agree well with the species described by Murrill (1913) from Jamaica (Guzmán-Dávalos, unpublished data). *G. bryophilus* is characterized by its eccentric, almost lateral stipe, fibrillose pileus and small basidiospores covered with small warts (Hesler, 1969; Horak, 1989). Previously it was only know from Jamaica, but it is very probable that it is widely distributed in the tropics but confused with other species, mainly because the eccentric stipe is not taken into consideration.

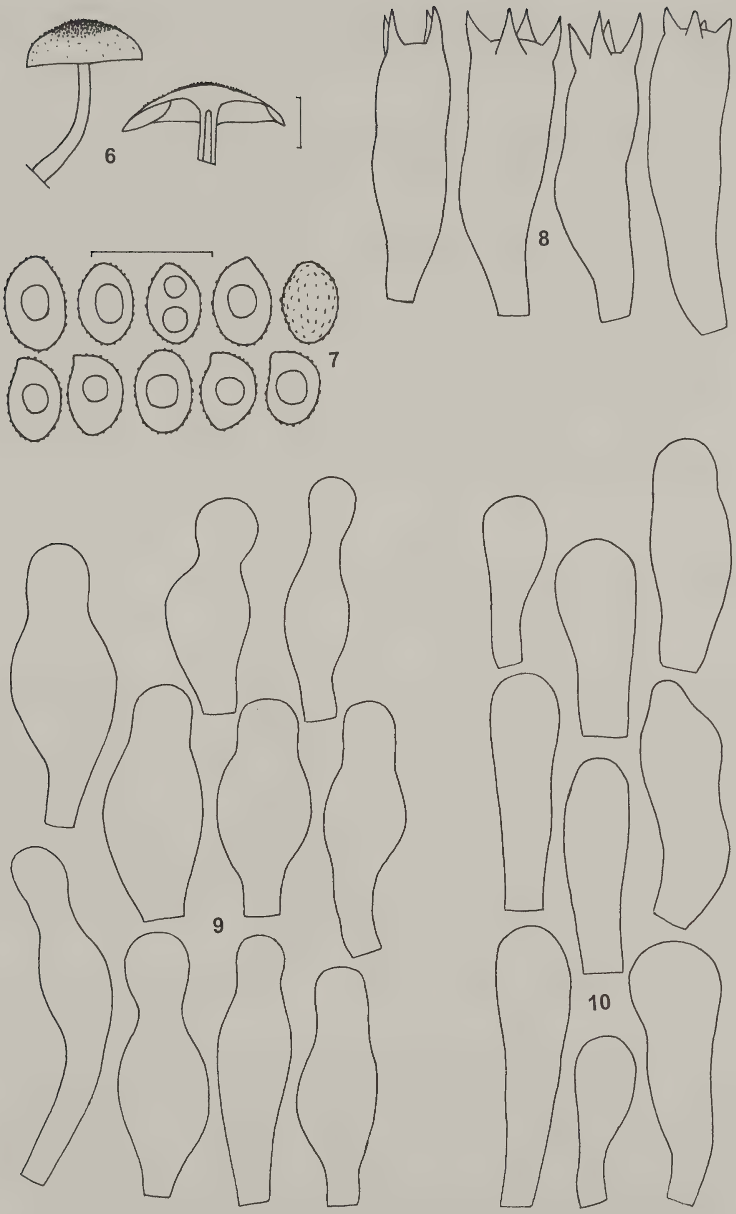
Gymnopilus dilepis (Berk. & Broome) Singer, Lilloa 22: 560, 1951.
Fig. 6 – 10

Pileus 10 – 40 mm diam., convex to plano-convex, at times slightly umbonate; surface light orange (5A5, 6A5) towards centre, pale orange (5A3) or light orange (5A4, 6A4) towards margin, tomentose when young, then squamulose; squamules purplish to blackish-brown, erect and comparatively denser at the centre, sparse and appressed in the middle, sparse or almost absent towards margin; margin decurved to plane, almost entire. Context concolorous with the pileus surface. Lamellae adnate, sometimes somewhat subdecurrent, light orange (5A5, 6A5) or orange (5A6), subdistant to close, ventricose, up to 6 mm wide, with lamellulae of 3 – 4 lengths; edge almost concolorous with the sides, entire to somewhat wavy. Stipe 20 – 40 x 2 – 6 mm, central, terete, almost equal or slightly tapering basally, hollow; surface pale or light orange (5A3 or 5A4), becoming brown or dark brown (6F6) towards base, sometimes with indistinct longitudinal striations. Veil not observed. Odour not distinctive. Pileus and stipe surface darken to orange-brown or purple (in the scales) with aqueous KOH on dry basidiomata. Spore-print light brown (6D8).

Basidiospores 6.4 – 8 (– 9.2) x 4.8 – 5.6 µm, Q = (1.21 –) 1.31 – 1.54 (– 1.64), ellipsoid, some broadly ellipsoid or ovoid, yellowish-brown, subthick-walled, verrucose, without plage, without germ-pore, orange-brown, dextrinoid, not metachromatic. Basidia 20.5–30.4 x 6–8.8 µm, clavate to cylindric-clavate, with or without central constriction, hyaline or with yellowish-brown content, 4-spored; sterigmata up to 5.6 µm long. Basidioles 20 – 28.8 x 6.4 – 8.8 µm, clavate, thin-walled, with granulose to homogeneous brown contents, scattered on lamella-edge and sides. Pleurocystidia absent or extremely rare, sublageniform, with subcapitate or capitate apex. Pseudocystidia 23.2 – 29.6 x 7.2 – 8.4 µm, clavate-rostrate or subfusiform, thin-walled, with granulose to homogeneous brown contents, present only in one material. Lamella-edge sterile with crowded cheilocystidia. Cheilocystidia 12.8 – 23.2(– 31.5) x 4.5 – 10.4 µm, apex 2.8 – 6 µm wide, utriform, clavate with a wide rostrum to lageniform with a short neck and a non-capitate or subcapitate apex, thin-walled, hyaline or yellowish. Hymenophoral trama subregular; hyphae 2 – 22.5 µm wide, thin- to subthick-walled, pale yellow to hyaline, sometimes with yellowish-brown content. Subhymenium inflated-ramose. Pileal trama radial; hyphae 2 – 20 µm wide, thin- to subthick-walled, yellowish. Pileipellis a cutis, at times disrupted by ascending hyphal bundles; hyphae 2 – 15 µm wide, thin-walled, encrusted with yellow to yellowish-brown pigment. Stipe trama composed of hyphae 2 – 29 µm wide, parallel, thin- to subthick-walled, yellowish. Stipitipellis a cutis; hyphae 2 – 11.5 µm wide, thin- to subthick-walled with yellow to brown wall pigment. Caulocystidia 18.4 – 68 (to very long) x 5.6 – 14.4 µm, cylindric, clavate, narrowly utriform, with obtuse or subcapitate apex, hyaline, some with granulose, yellow or orange-brown content, thin-walled, in tufts at the stipe apex, less differentiated but present at the middle and base of stipe. Clamp-connexions present on all hyphae. In one material (Thomas T13), a yellowish pigment dissolves when lamellae are mounted in KOH.

On dead coconut trunk, scattered, June.

Specimens examined: India, Kerala State, Malappuram District, Calicut University Campus, 12 June 1996, A. Thomas T13 (IBUG); 14 June 1996, A. Thomas T13b (IBUG).



Figs. 6–10. *Gymnopilus dilepis*, 6: basidiomata, 7: basidiospores, 8: basidia, 9: cheilocystidia, 10: basidioles. Scale bar = 10 mm for basidioma and 10 µm for microstructures.

Additional materials examined: Sri Lanka, Central Prov., Kandy Distr., Peradeniya, on dead wood, January 1859, Thwaites 878 (K 75157, Type of *G. dilepis*). USA, Florida, Natural Bridge, on gum log, July 31, 1954, T. H. Campbell 21453 (TENN, Type of *G. lepidotus*).

Gymnopilus lepidotus Hesler described from Florida (Hesler, 1969) is very similar, and it could be a later synonym of *G. dilepis*. Both species have subfusoid basidioles or cystidia with coloured contents that could be interpreted as pseudocystidia, because usually they are born under the subhymenium and have oily contents. The pseudocystidia can be very abundant or completely absent, depending on the specimen observed. Examination of the type materials of the two species (Guzmán-Dávalos, unpublished data), reveals that the cheilocystidia tend to be more lageniform and with a longer neck in *G. lepidotus*. The geographical distributions of the two species are also different, neotropical in *G. lepidotus*, and paleotropical in *G. dilepis*. Another difference observed in the Indian materials, is the reaction of the dry pileus with aqueous KOH, being orange-brown, instead of the dark blood-red color seen in *G. lepidotus*. This reaction could not be observed in the type of *G. dilepis*, and hence we do not know if the reaction observed in the Indian materials is typical of the species.

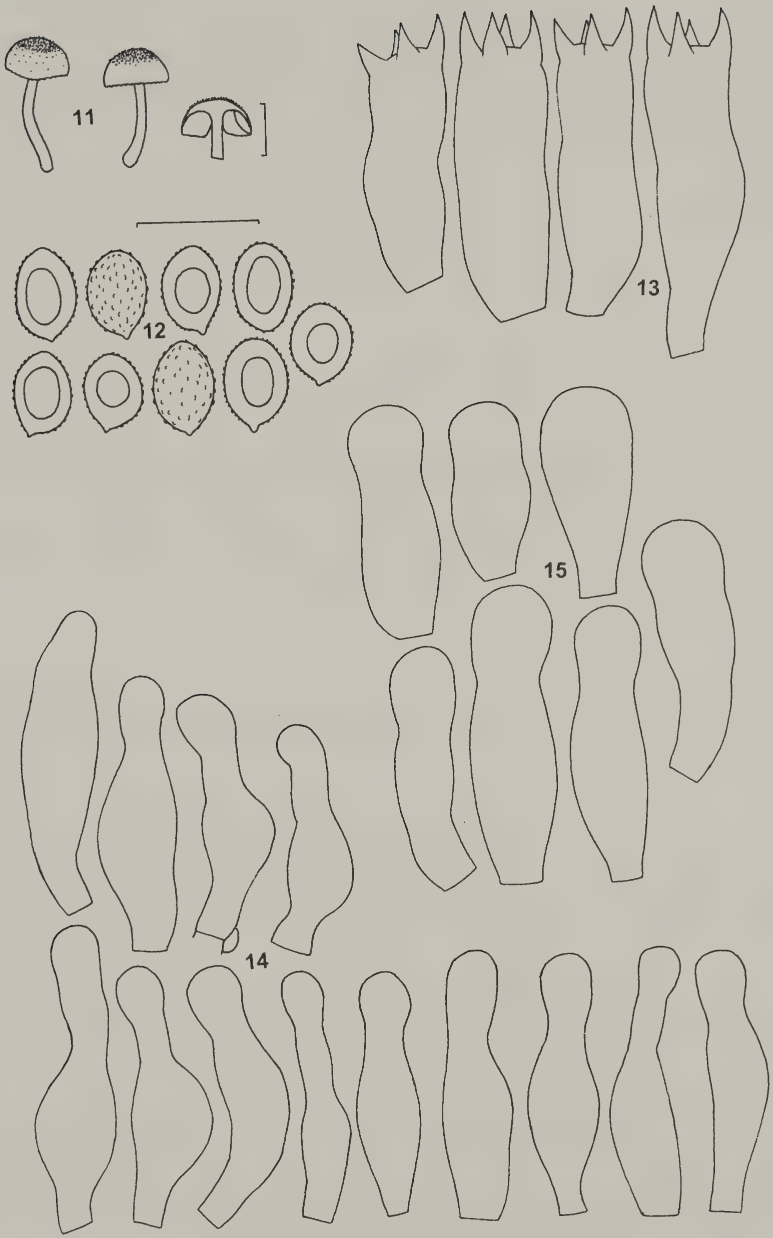
Gymnopilus dilepis has already been recorded from Kashmir, India by Abraham (1994), on a decayed coniferous stump. It is also known from Sri Lanka, Java, Malaysia, Papua New Guinee and Sumatra (Pegler, 1986; Treu, 1998).

Gymnopilus terricola K. A. Thomas, Guzm.-Dáv. & Manim., **sp. nov.**
Fig. 11 – 15
Etymology: *terricola* (Latin), dwelling on the ground.

Basidiocarpus terricolus. Pileus 6-18 mm latus, hemisphaericus vel convexus, ad discum pallide brunneus vel rubro-brunneus, ad marginem pallide aurantiacus vel griseo-aurantiacus, siccus, primo tomentosus, postea squamulosus. Lamellae sinuatae vel adnexae, primo pallide aurantiacae, postea aurantiacae vel brunneo-aurantiacae, subdistantes, usque 5 mm latae, lamellulis intermixtae. Stipes 10-25 x 1-2.5 mm, centralis, cylindricus, cavus, ad apicem pallide aurantiacus, ad basim griseo-aurantiacus vel cyano-griseus, raro zonam annuliformem formentus. Odor nullus. Sporae 6.5-8.4 x (4.5-) 5.2-6 μm, late ellipsoideae, ellipsoideae vel subamygdaliformiae, verrucosae, aurantiaco-brunneae, dextrinoideae. Basidia 20.8-31.2 x 6.4-8.4 μm, 4-sporigera. Cheilocystidia 18.4-29 x 4.9-7.5 μm, fusoidea, utriformia vel lageniformia. Pleurocystidia nulla. Epicutis pilei disrupta, ex hyphis 3-16 μm latis composita. Caulocystidia 17.2-48.4 x 3.6-10.8 μm, versiformia. Hyphae omnes fibulatae.

Holotypus: India, Kerala State, Malappuram District, Calicut University Campus, 10 June 1998, K. A. Thomas T261 (IBUG).

Pileus 6 – 18 mm diam., hemispherical to convex; surface light brown (6D7, 7D6) or reddish-brown (8D6, 8E6) at the disc, light orange (5A4) or greyish-orange (5B4, 6B4) towards margin, dry, tomentose when young, then fibrils joining to form erect to suberect squamules, especially in the disk; fibrils reddish-brown to purplish; margin decurved, entire, sometimes fissile, occasionally appendiculate. Context pale orange (5A3), less than 1 mm at the disc. Lamellae sinuate to adnexed, light orange (5A4, 6A4) when young, becoming orange (6B7, 6B8) or brownish-orange (6C7) when mature, subdistant, ventricose, up to 5 mm wide, with lamellulae of 2–3 lengths; edge concolorous with the sides, entire to slightly wavy, lamellae exceeding pileus margin. Stipe 10–25 x 1–2.5 mm, central, terete, almost equal, hollow; surface pale orange (5A3) towards apex, greyish-orange (5B3, 5B4) or faintly bluish-grey towards base, fibrillose apically. Veil fibrillose, evanescent, in some cases forming a superior annular zone



Figs. 11–15. *Gymnopilus terricola*, 11: basidiomata, 12: basidiospores, 13: basidia, 14: cheilocystidia, 15: basidioles. Scale bar = 10 mm for basidiomata and 10 µm for microstructures.

with flaps or fibrils. Odour none. Pileus surface darkens to reddish-black with aqueous KOH on dry basidiomata. Spore-print brownish-orange (6C7) to brown (6D7).

Basidiospores 6.5 – 8.4 x (4.5 –) 5.2 – 6 μm, Q = (1.21 –) 1.27 – 1.38(– 1.5), broadly ellipsoid to ellipsoid, occasionally subamygdaliform, with obtuse or subacute apex, subthick-walled, verrucose, without plage or with a very poorly developed one, without germ-pore, orange-brown, dextrinoid, not metachromatic. Basidia 20.8 – 31.2 x 6.4 – 8.4 μm, clavate to cylindric-clavate, sometimes with a median constriction, hyaline, with or without orange-brown contents, 4-spored; sterigmata up to 4.5 μm long. Basidioles 12.5 – 30.4 x 5.5 – 9 μm, clavate to narrowly clavate, hyaline, or with yellowish-brown or orange-brown granulose content, scattered on the edge and sides of lamellae. Lamella-edge heteromorphous with scattered or occasionally crowded cheilocystidia. Pleurocystidia absent. Cheilocystidia 18. 4 – 29 x 4.4 – 7.5 μm, apex 3.2 - 4 μm wide, fusoid, narrowly utriform, cylindric-subventricose to lageniform, with obtuse or subcapitate apex, thin-walled, hyaline or with yellowish content. Hymenophoral trama subregular; hyphae 2 – 16.5 μm wide, thin-walled, with yellow to orange-yellow content. Subhymenium ramose. Pileal trama radial; hyphae similar to those of hymenophoral trama. Pileipellis a disrupted cutis; hyphae 3 – 16 μm wide, with a thin, orange-brown wall, encrusted in bands with an orange-brown pigment, often aggregating into erect fascicles with clavate, clavate-mucronate, or fusoid end-cells. Stipe trama composed of 1.5 – 16.5 μm wide hyphae, thin-walled, with a light yellow pigment. Stipitipellis a cutis, hyphae 2.5–13 μm wide, thin-walled, light yellowish brown, at times faintly encrusted. Caulocystidia 17.2 – 48.4 x 3.6 – 10.8 μm, apex 2.8 – 8.4 μm wide, cylindric, clavate or lageniform, with obtuse, subcapitate or rostrate apex, hyaline, with or without yellow or orange-brown granulose content, thin-walled, in tufts at the apex and middle of the stipe. Clamp-connexions present in all parts of the basidioma. A yellowish pigment dissolves when lamellae are mounted in KOH.

On the ground, scattered, not attached to any decaying ligno-cellulosic material, May-June.

Specimens examined: India, Kerala State, Malappuram District, Calicut University Campus: 10 June 1998, A. Thomas T261 (IBUG, Holotype); 11 June 1998, A. Thomas T261b (IBUG); 12 June 1998, A. Thomas T261c (IBUG); 12 May 1999, A. Thomas T261d (IBUG); 16 May 1999, A. Thomas T261e (IBUG).

This species is very similar to the Sri Lankan species, *Gymnopilus crocias* (Berkeley & Broome) Singer but the Sri Lankan species is lignicolous whereas the Kerala collections were always growing on soil. The spore morphology is also different (Pegler, 1986). There are several terrestrial species of *Gymnopilus* but none of them agrees fully with the Kerala collections. In *G. terrestris* Hesler, the pileus is glabrous, both pleurocystidia and cheilocystidia are absent and there is no yellow pigment in the lamellae when mounted in KOH. *Gymnopilus abramsii* Murrill has bigger basidiomata with grey-brown pileus, white context and interwoven pileal trama. In *G. arenicola* Hesler, the pileus is not squamulose, and the basidiospores are subfusoid to pip-shaped. In *G. rufobrunneus* Hesler, the pileus is glabrous and hygrophanous, the basidiospores are bigger, and both pleurocystidia and cheilocystidia are absent. In *G. humicola* P. R. Harding ex Singer, the basidiomata are bigger, with aromatic odour and different type of ornamentation on the pileus. *Gymnopilus fulgens* (Favre & Maire) Singer that grows on peaty or burnt soil has glabrous pileus and the basidiospores are bigger with very prominent warts. *Gymnopilus angustifolius* Hesler has fragrant odour, narrow lamellae and pileocystidia in mounds. *Gymnopilus decipiens* (W. G. Smith) Orton occurs on burnt soil and has lageniform-capitate to lecythiform cystidia. *Gymnopilus odini* (Fr.) Kühner & Romagnesi has glabrous to fibrillose cap and occurs either on peaty humus soil or on burnt soil (Kühner & Romagnesi, 1953; Singer, 1961; Orton, 1960, 1993; Moser, 1983, Høiland, 1990).

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MICROBOTRYUM SILYBUM SP. NOV. (MICROBOTRYALES)

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Key Words: *Microbotryum*, smut fungi, new species, biological control

Abstract. During a study of plant pathogens as potential biological control agents of invasive *Carduus* and other thistles in the USA, a new species of *Microbotryum*, *M. silybum*, was discovered on *Silybum marianum* from Greece. A key to the seven *Microbotryum* species on Compositae is presented.

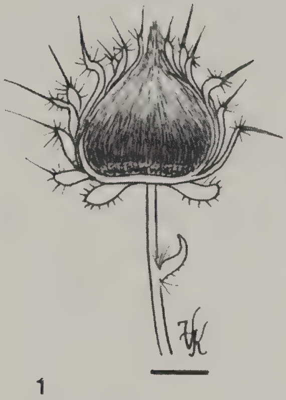
Carduus species and the related thistles *Silybum marianum* (L.) Gaertn. and *Onopordum acanthium* L. are problematic invasive weeds in the USA and targets of classical biological control efforts. During a collection trip in June 2001 to find potential pathogens of these weeds, numerous smutted flower heads (capitula) of *S. marianum* were found in a weedy field in south-eastern Greece, mixed with healthy plants. When smutted capitula were split open, powdery masses of teliospores were found in all ovaries and florets. All of the capitula on infected plants were similarly infected, and no seeds were found from infected plants. As all capitula and florets on diseased plants were infected, it is likely that the infections were systemic. Teliospores from smutted ovaries conformed roughly to the description for *Microbotryum cardui* (A. A. Fischer Waldh.) Vánky. However, in capitula of Compositae six *Microbotryum* species are known (comp. also Vánky, 1994, 1998): **1. *M. cardui*** (A. A. Fischer Waldh.) Vánky, lectotype on *Carduus acanthoides* L., Germany, **2. *M. cichorii*** (H. Sydow) Vánky, type on *Cichorium intybus* L., Germany, **3. *M. onopordi*** (Vánky) Vánky, type on *Onopordum bracteatum* Boiss. & Heldr. subsp. *ilex* (Janka) Franko, Greece, **4. *M. scolymi*** (Roum. & Trabut ex Juel) Vánky, type on *Scolymus grandiflorus* Desf., Algeria, **5. *M. scorzonerae*** (Alb. & Schwein.) G. Deml & Prillinger, type on *Scorzonera humilis* L., Germany, and **6. *M. tragopogonis-pratensis*** (Persoon) R. Bauer & Oberw., type on *Tragopogon pratensis* L., Germany. Of these 2, 4, 5 and 6 are on host plants in the Subfamily Cichorioideae, 1 and 3 on Subfamily Asteroideae, Tribe Cardueae.

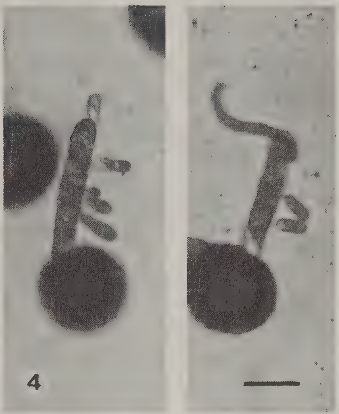
To more accurately determine what species was present in the *S. marianum* capitula, specimens were dried, sent to the senior author, and deposited in the Herbarium Ustilaginales Vánky (HUV) where the following procedures were conducted. For light microscopical (LM) studies, dried spores were rehydrated in lactophenol by gently heating to boiling point under a cover glass and studied with an oil immersion lens at a magnification of 1000x (Caution: with time, in lactophenol, the wall of the spores swells rather considerably and are no longer proper for measurements and comparison). For scanning electron microscopical (SEM) studies, spore balls were dusted on double-sided adhesive tape, mounted on a specimen stub, sputter-coated with gold-palladium, ca. 20 nm, and examined in a scanning electron microscope at 10 kV. Spore germination was obtained on water agar (WA), in Petri-dishes, at room temperature, in 2 days.

In the HUV there are two *Microbotryum* species collected in Greece, from the same locality: one is the type of *M. onopordi* on *Onopordum bracteatum*, the other, identified as "*M. cardui*", is on *Silybum marianum* (L.) Gaertner. To determine which species was found on *S. marianum*, the two collections on *Silybum* (one from HUV and the other recently collected in Greece) were compared with the lectotype of *M. cardui*. These examinations revealed enough differences in spore morphology to consider the smut from *S. marianum* and *M. cardui* as two different species and not as a variation within the same species.

Microbotryum silybum Vánky & Berner, **sp. nov.**

Typus in matrice *Silybum marianum* (L.) Gaertner, Graecia, Thessalia Div., Lárisa Prov., prope urbem Lárisa, 39°24'02" N, 22°25'40" E, alt. cca. 274 m.s.m., 27.V.2002, leg. D. Berner & J. Kashefi. Holotypus in Herbario Ustil. Vánky, HUV 20122, isotypi in Vánky, Ust. exs. no. 1188. Paratypus: Lárisa Prov., Halkiades, 27.VII.1990, leg. A. Shepard, comm. S. Hasan, HUV 15098!





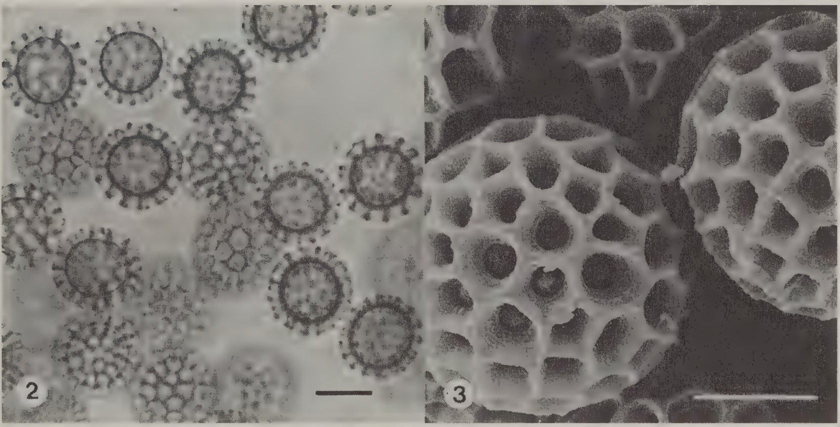


Fig. 1. Sori of *Microbotryum silybum* Vánky & Berner, in all florets of a sectioned flower head of *Silybum marianum* (L.) Gaertner (type). Enlarged two infected florets with infected seeds.

Bars = 1 cm for habit, 3 mm for detail drawings.

Figs. 2, 3. Spores of *Microbotryum silybum* Vánky & Berner on *Silybum marianum* (L.) Gaertner, in LM and in SEM (paratype).

Bars = 10 µm for LM, 5 mm for SEM picture.

Fig. 4. Germinating spores of *Microbotryum silybum* Vánky & Berner on *Silybum marianum* (L.) Gaertner. Four-celled basidia giving rise to lateral and terminal, ovoid basidiospores and a hypha (stained with cotton blue; paratype).

Bar = 10 µm.

Sori in flosculis et seminibus, illos massa atra, brunneoviolacea sporarum partim implentes. Flosculi omnes capitulorum eorumdem affecti. *Sporae* forma et magnitudine relative uniformes, globosae, subglobosae usque ellipsoidales, 13–16,5 x 13–17,5 µm, colore violaceo tinctae, pallide usque mediocriter atrobrunneae; pariete alte reticulato, in margine sporarum sicut alae grossae, radiatae apparenti, maculis in diametro sporarum 4–6, polyangularibus, muri (1,5–)2–3 µm alti, in visu mediano opticali sicut spinae obtusae, ad basim 0,5–1 µm crassae; gradatim tenuiescentes apparentes, in SEM plus-minus rotundae vel subpolyangulares, muri et interspacia levia usque leniter verruculosa.

Sori (Fig. 1) in the florets and seeds which are partly replaced by a dark, brownish-violet, powdery mass of spores. All florets in the capitula are affected. *Spores* (Figs. 2, 3) relatively uniform in shape and size, globose, subglobose to ellipsoidal, 13–16.5 x 13–17.5 µm, violet tinted pale to medium dark brown; wall deeply reticulate appearing as coarse, radiate wings on the spore margin, 4–6 polyangular meshes per spore diameter, muri (1.5–)2–3 µm high, in optical median view appearing as gradually narrowing blunt spines, 0.5–1 µm wide at their basis; in SEM meshes more or less rounded or subpolygonal, wall and interspaces smooth to finely verruculose. *Spore germination* (Fig. 4; on water-agar, in 2 days, at room temp.) results in four-celled basidia measuring 4–5 x 25–36 µm. On the basidia, laterally and terminally, ovoid, 2–3.5 x 4–6 µm large basidiospores are produced. After fusion of compatible basidiospores or basidial cells, dikaryotic hyphae result. In nutrient media basidiospores give rise to yeast cultures.

On Compositae (Subfam. Asteroideae): *Silybum marianum* (L.) Gaertner; Germany, Greece.

For comparison, the description of *M. cardui* is also given, based on the lectotype specimen.

Microbotryum cardui (A. A. Fischer Waldh.) Vánky, 1998:41.

Ustilago cardui A. A. Fischer von Waldheim, 1867:255. — *Ustilago reessiana* J. G. Kühn, in Rabenhorst, Fgi. eur. no. 1798 & 1799, 1874; 1874:58 (nomen novum superfluum pro *U. cardui*). — Lectotype (designated by Vánky, 1985:200) on *Carduus acanthoides* L., Germany, Sachsen, near Halle a/S., 1863, M. Reess, HUV 3527!; isolectotypes in Rbh., Fgi. eur. no. 1799 (as *U. reessiana*).

Sori in the florets and seeds, filling the capitula with a dark brownish-purple, powdery spore mass. Infected heads do not open completely, and in *Carduus acanthoides* the flowers remain pale red (Reess, in Kühn, in Rabenhorst, 1874:59). *Spores* relatively variable is shape and size, subglobose, usually ovoid, ellipsoidal, more rarely slightly irregular, 14.5–19 x 15–20 µm, violet tinted pale to medium yellowish-brown; wall deeply reticulate appearing as coarse, radiate wings on the spore margin, (4–)5–8 polyangular meshes per spore diameter, muri 2–4 µm high, in optical median view appearing as gradually narrowing blunt spines, 0.5–1 µm wide at their basis; in SEM meshes more or less rounded or subpolygonal, wall and interspaces finely verruculose.

On Compositae (Subfam. Asteroideae): *Carduus acanthoides* L., *C. crispus* L., *C. defloratus* L., *C. kerneri* Simonkai, *C. nutans* L., *C. personata* (L.) Jacq.; Europe, Asia (comp. also Zundel, 1953:149).

Key to the *Microbotryum* species on Compositae

1. Spore mass pale brownish-violet. Muri in median view spiniform.
   On *Onopordum* .... *M. onopordi*
– Spore mass dark brownish-violet. Muri in median view not spiniform 2
2. Muri over 1.5 µm high. Spores uniformly pigmented 3
– Muri up to 1.5 µm high. Spores often lighter on one side 5
3. Reticulum in median view do not appear as radiate marginal wings.
   Meshes per spore diam. 6–10. On *Scolymus* .... *M. scolymi*
– Reticulum in median view appear as radiate marginal wings.
   Meshes per spore diam. up to 8 4
4. Spores relatively variable, 15–20 µm long. Meshes per spore
   diam. (4–)5–8. Muri 2–4 µm high. On *Carduus* .... *M. cardui*
– Spores relatively uniform, 13–17.5 µm long. Meshes per spore
   diam. 4–6. Muri (1.5–)2–3 µm high. On *Silybum* .... *M. silybum*
5. Spores 10–15 µm long. On *Scorzonera* .... *M. scorzonerae*
– Spores 13–19 µm long 6
6. Interspaces with evident warts. On *Tragopogon* .... *M. tragopogonis-pratensis*
– Interspaces without evident warts. On *Cichorium* .... *M. cichorii*

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YUEA, A NEW GENUS IN XYLARIALES

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Abstract: The new genus *Yuea* (Xylariales) is based on *Anthostoma chusqueicola,* a bambusicolous pyrenomycete with immersed, non-stromatic ascomata, asci with a low and wide, I+ ring, and ascospores with helical germ slit.

Keywords: bambusicolous, Amphisphaeriaceae, Xylariaceae, helical germ slit.

INTRODUCTION

Some genera described in Xylariales have ascospores with a helical germ slit, e.g. *Helicogermslita* Lodha & D. Hawksw., *Obolarina* Pouzar and *Spirogramma* Ferd. & Winge. The type species of *Spirogramma, S. boergesenii* Fred. & Winge, was transferred to *Xylaria* by Cannon (1987), although most species in that genus have a straight germ slit there are dozens with a more or less helical or sigmoid slit. Cannon listed 18 members of the Xylariales with ascospores provided with a helical germ slit. To his list can be added several species, e.g. *Anthostoma chusqueicola* Speg. This fungus is not closely related to the generic type *Anthostoma decipiens* Lam. & DC., which belongs in the Diatrypaceae (Eriksson 1966, Rappaz 1992, Læssøe & Spooner 1994), now named *Cryptosphaeria decipiens* (Lam. & DC.) Læssøe & Spooner. It has allantoid ascospores devoid of germ slit as other members of the Diatrypaceae. *Anthostoma chusqueicola* can not be accommodated in any of the currently recognized genera in Xylariales in which one or more species have been reported to have a helical germ slit (*Amphisphaeria, Anthostomella, Biscogniauxia, Entosordaria, Helicogermslita, Hypoxylon, Kretzschmaria, Leptomassaria, Rosellinia, Stilbohypoxylon,* and *Xylaria),* and neither in any of the other genera in the order with a straight germ slit. Therefore, the new genus *Yuea* is proposed.

Yuea O.E. Erikss., gen. nov.

(Etymology: named in honour of Dr. Yue Jing-zhu, zymologist, pyrenomycologist and mycological artist, San Francisco, USA. Note, pronounciation of the new generic name is about as in German "Üäa").

Stromata nulla. Perithecia laxe gregaria, ligno omnino immersa, subglobosa, membranacea. Periphyses et paraphyses numerosae, filiformes. Asci cylindrici, breviter stipitati, unitunicati, annulo apicali in liquore Melzeri cyanescente, 8-spori. Ascosporae uniseriatae, ellipsoidae - subcylindricae, utrinque normaliter rotundatae, brunneae, non-septatae, rima germinativa spirale longa praeditae, tunica mucosa hyalina.

Type species: *Yuea chusqueicola* (Speg.) O.E. Erikss. (holotypus).

Yuea chusqueicola (Speg.) O.E. Erikss. comb. nov. **Fig. 1**

Anthostoma chusqueicola Speg. - *Rev. Fac. Agr. Veter. La Plata* ep. 2, 6: 44 (1910).

Perithecia scattered, each seated in a separate cavity in the bamboo wood and covered by a thin crust of mealy bamboo fragments, flattened subglobose, ca. 500-700 μm wide and 300-400 μm high, non-clypeate or with a faint blackening in a narrow zone around the ostiole, with a rather broad and short central neck and when dry with a hollow centrum and shiny black hymenium (swelling and filling the hollow if water is added). Ostiolar region slightly raised or not. Wall ca. 15-20 μm thick, outer parts brown, inner parts hyaline, of strongly compressed thin-walled cells. Hamathecium of periphyses in the ostiolar canal and ca. 1 μm wide, sparsely branched paraphyses in hymenial gel between the asci. Asci 250-300 x 10-12 μm (acc. to Spegazzini 1910, but the material is old, asci burst and the length can not be measured, width c. 11-12 μm), cylindrical, short-stalked, thin-walled, but thicker at the apex and with a low, ca. 5 μm wide, I+ and KOH/I+ blue ring that is round in optical cross section, 8-spored. Ascospores (20-) 25-30 (-32) x (7-) 8-10 (-11) μm, over-lapping uniseriate, ellipsoid - subcylidrical, equilateral or slightly inequilateral, terete or slightly compressed, apically usually rounded, but some spores attenuated towards one or both ends, brown, smooth (oil imm.), non-septate, with a few rather large oil drops of irregular shape, with a germ slit spiralling one full circumference and reaching to about 5 μm from the ends of the spores, with a distinct, firm, ca. 0.7 μm wide gelatinous sheath (unchanged in KOH).

Habitat: culms of *Chusquea cummingii.*

Known distribution: Chile.

Material studied: Chile, Valparaiso, on *Chusquea cummingii*, -.i.1909, leg. C. Spegazzini 6805 (**LPS,** holotype).

DISCUSSION

Yuea chusqueicola is a bambusicolous pyrenomycete with immersed, non-clypeate perithecia, cylindrical asci with a low, wide, I+ blue apical ring, and non-septate, brown ascospores, with helical germ slit. It is, no doubt, a member of Xylariales, but the

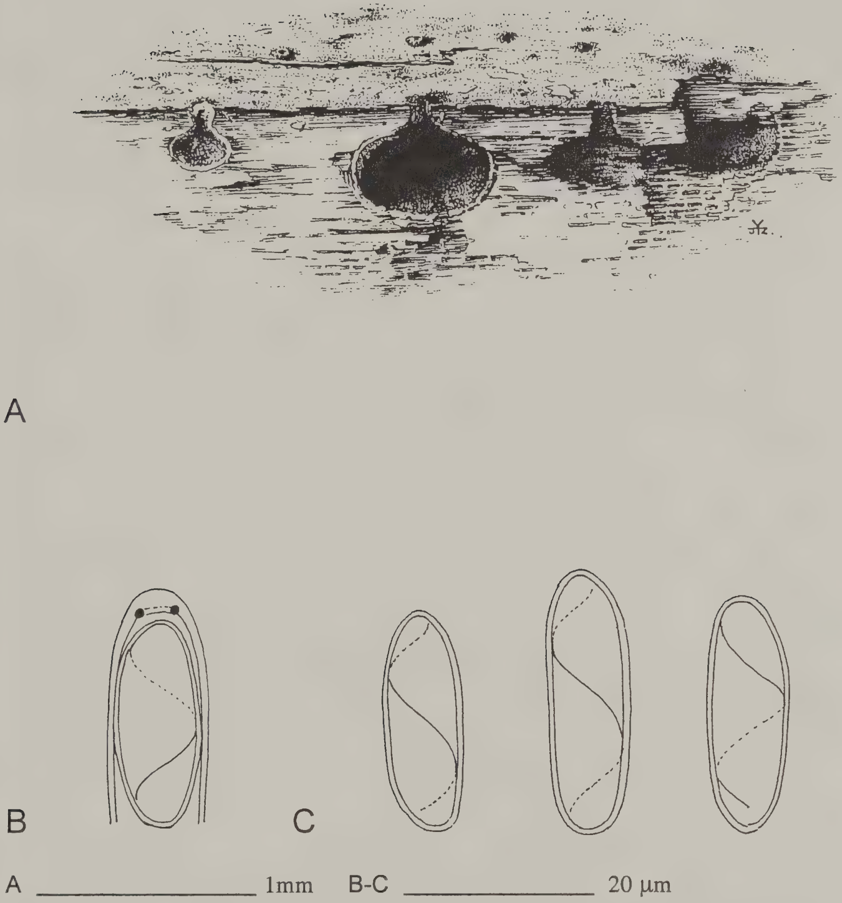

Fig. 1. *Yuea chusqueicola*. (A) Ascomata in a culm of *Chusquea cummingii*. (B) Ascus top. (C) Ascospores. - Scale: (A) 10 mm. (B-C) 30 μm. - Material: Spegazzini no. 6805 (**LPS**, type of *Anthostoma chusqueicola)*.

position of the new genus in the order is uncertain. As mentioned above, Cannon (1987) listed 18 species in Xylariales with helical germ slit. Some species can be added, and the following genera have to be considered:

(1). Genera and species with perithecia embedded in a distinct stroma :

Biscogniauxia	*B. marginata* (Fr.) Pouzar (Ju *et al.* 1998).
Helicogermslita	*H. celastri* (S. Kale & V. Kale) Lodha & D. Hawksw. and 3 or 4 other species (Læssøe & Spooner 1994). — *Anthostoma vincensii* Arnaud (Cannon 1987) is *Helicogermslita gaudefroyi* (Fabre) Læssøe & Spooner.
Hypoxylon	*H. curvirimum* Y.-M. Ju, J.D. Rogers & Lodge, *H. fendleri* Berk. (Ju & Rogers 1996).
Kretzschmaria	*K. curvirima* J.D. Rogers & Y.-M. Ju (Rogers & Ju 1998).
Rosellinia	several species (Læssøe & Spooner 1994).
Stilbohypoxylon	*S. quisquiliarum* (Mont.) J.D. Rogers & Y.-M. Ju (Læssøe & Spooner 1994).
Xylaria	several species (Cannon 1987, Læssøe & Lodge 1994, Læssøe 1999).

(2). Genera and species without a distinct stroma and with or without a clypeus:

Amphisphaeria	*A. canicollis* P. Karst. — Members of this genus have 2-celled ascospores without germ slit, and Karsten´s fungus should be restudied.
Anthostomella	several species (Cannon 1987). — Differs from *Yuea* in clypeate ascomata, asci with cylindrical or barrel-shaped amyloid plug, and ascospores with dwarf cell, at least when immature.
Entosordaria	*E. spiralis* E. Müll. — This species should be restudied. The type species has clypeate ascomata, flattened ascospores with dwarf cell and the larger cell with apical radiating slits.
Leptomassaria	*L. simplex* (Nitschke ex Otth) Petr., *L. unedonis* (De Not.) Rappaz. — Differs from *Yuea* in a white and well developed prosenchymatous entostroma near the peridium and a discoid to cylindrical I+ apical ring in asci (see Rappaz 1995).

Anthostoma chusqueicola can not be accommodated in any of the genera in the first group characterized by distinct stromata. Of the genera in the second group, the three first mentioned have spores with one septum, at least when young and immature. Only *Leptomassaria* shows a resemblance with *Anthostoma chusqueicola* in scattered immersed ascomata, non-septate ascospores (also when young) with a thin gelatinous sheath, not dissolving in KOH. However, the two *Leptomassaria* species have a well developed entostroma and the apical ring in the asci is discoid to cylindrical. No entostroma is seen in *Anthostoma chusqueicola* and the apical ring is thin, round in optical cross section and with a wide opening. Thus, none of the genera that has been known to contain species with a helical germ slit can accommodate this species. Therefore, the new genus *Yuea* is proposed.

Some of the genera discussed above contain both species with a helical germ slit and others with a straight germ slit. There was, therefore, the possibility that *Anthostoma chusqueicola* should be referred to a genus for which hitherto only species with a straight germ slit were known. However, none of these genera are characterized by non-stromatic ascomata, a thin and wide I+ apical ring in asci, ascospores without septum also when immature.

There is a second collection in LPS labelled *Anthostoma chusqueicola* (Chile, Los Perales, on *Chusquea cummingii,* 1918, leg. C. Spegazzini 6807). Drawings by Spegazzini on the envelope show a fungus with 1-septate spores. This turned out to be an *Amphisphaeria* sp. with a smaller I+ apical ring in the asci (c. 4 µm wide with narrow opening). The ascospores have one median septum, are longitudinally striated, lack germ slit, and measure ca. 26-29 x 8-9 µm.

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NEW SPECIES OF THE GENUS ASTERINA FROM CHINA III*

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ABSTRACT

Asterina altingiae parasitic on *Altingia chinensis*, *Asterina bruceae* parasitic on *Brucea javanica*, *Asterina loropetali* parasitic on *Loropetalum chinense*, and *Asterina pouteriae* parasitic on *Pouteria grandifolia* are described and illustrated as new species.

Key words: Asterinaceae, *Asterina altingiae*, *Asterina bruceae*, *Asterina loropetali*, *Asterina pouteriae*

1. *Asterina altingiae* sp. nov. (Fig. 1)

Coloniae epiphyllae, atrae, tenues, arachnoideae, ad 2 mm diam., raro confluent. Hyphae atro-brunneae, sinuatae, opposite vel irregulariter acuteque vel wideque ramosae, laxe vel dense reticulatae, cellulis 18-28 X 3-4 µm. Appressoria bicellula, alternata vel unilatera, antrorsa, sinuata vel recta, 8-12 µm longa; cellula basali cylindracea vel cuneata, 2-5 µm longa; cellula apicali subglobosa, angulosa vel lobula, raro integra, 5.5-7.5 X 5-7.5 µm. Ascomata dispersa vel laxe aggregata, atra, orbiculata vel hemisphaeria, ad 120 µm diam., stellate dehiscentia ad centrum, irregulariter margina crenata vel fimbriata, cells 2-3 µm lata; ascosporae oblongae vel ellipsoideae, atro-brunneae, 1-septatae, obtusae, constrictae, laeves, 19-23 X 7.5-11 µm. Pycnidia pauca, dispersa, hemisphaeria, stellate dehiscentia ad centrum, irregulariter crenata ad peripherica, ad 100 µm diam.; conidia unicellula, late ovata vel subovata, atro-brunnea, hyaline et mediato, 10-15 X 6.5-10 µm.

Colonies epiphyllous, black, thin, arachnoid, up to 2 mm in diameter, rarely confluent. Hyphae brown, sinuous, opposite or irregular branching acutely or lately, loosely or densely reticulate, cells 18-28 X 3-4 µm. Appressoria 2-celled, alternate or unilateral, spreading, bent or straight, 8-12 µm long; stalk cells cylindrical to cuneate, 2-5 µm long; head cells nearly globose, angulose to lobate, rare entire, 5.5-7.5 X 5-7.5 µm. Ascomata scattered to loosely aggregate, black, orbicular or hemispherical, up to 120 µm in diameter, a broad or stellately dehiscent at central, irregularly crenate to shortly tasseled at periphery, surface cells 2-3 µm wide; ascospores oblong or ellipsoid, brown, 1-septate, obtuse, constricted at septum, surface smooth, 19-23 X 7.5-11 µm. Pycnidia few, similar to ascomata, scattered, hemispherical, black, up to 100 µm in diameter, stellately dehisced at the central, crenate at periphery; conidia unicellular, widely ovate or nearly ovate, brown, hyaline in mediate, 10-15 X 6.5-10 µm.

Holotype: On leaves of *Altingia chinensis* (Champ.) Oliver.(Hamamelidaceae). Xiaohu, Fujian Province, China.September 8, 1987, Y. X. Hu, HMIGD 31717.

Etymology: *altingiae*, in reference to the host species, *Altingia chinensis.*

The present species is closely related to *Asterina distyliicola* Hino & Katumoto. The distinguishing character of *A. distyliicola* are that the ascospores are larger (23.5-32.5 X 10-13.5 µm) and the appressoria are opposite (Hino & Katumot, 1956), and it is found mixed with *Meliola altingiae* B. Song et Y. X. Hu.

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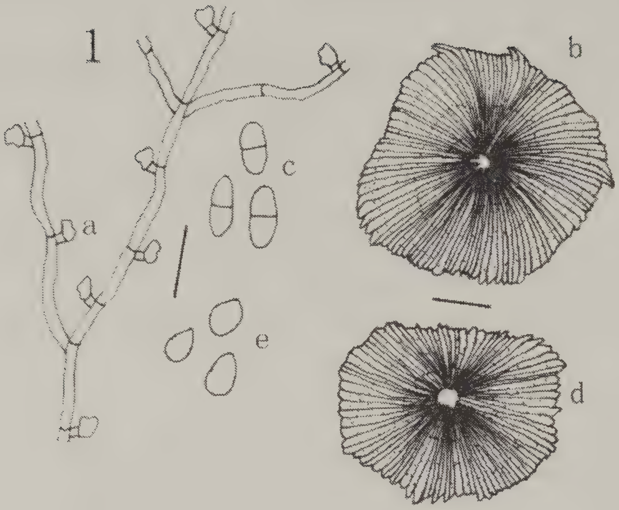


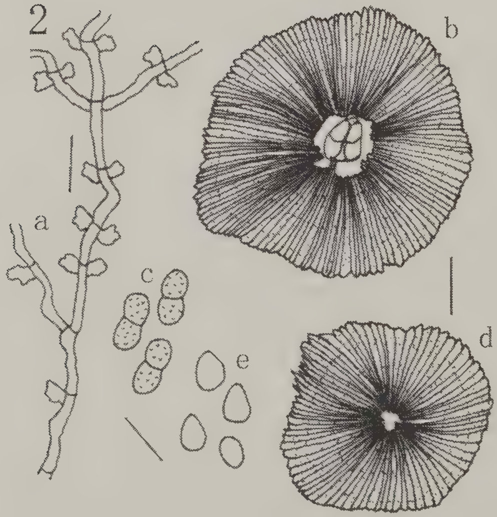


Fig.1 *Asterina altingiae* (a. hyphae with appressoria; b. ascomata; c. ascospores; d. pycnidium; e. conidia). (Bars=25μm).

Fig.2 *Asterina bruceae* (a. hyphae with appressoria; b. ascomata; c. ascospores; d. pycnidium; e. conidia). (Bars=25μm).

2. ***Asterina bruceae*** sp. nov. (Fig. 2)

Coloniae amphigenae, plerumque epiphyllae, atrae, tenues vel subdensae, arachnoideae vel velvulae, ad 5 mm diam., raro confluent. Hyphae atro-brunneae, subrectae vel undulatae, opposite vel irregulater acuteque vel wideque ramosae, laxe vel dense reticulatae, cellulis 17-33 X 4.5-5.5 µm. Appressoria uicellula, opposita vel 10% alternata, antrorsa, plerumque sinuata, subellipsoidea vel cylindracea, 1-3-lobula vel raro angulsa, 5-11 X 5-9.5 µm. Ascomata laxe aggregata vel dispersa, atra, orbiculata vel hemisphaeria, ad 180 µm diam., nulla cava vel stellate dehiscentia ad centrum, irregulariter margina crenata vel fimbriata, cells 2-3 µm lata; ascosporae oblongae vel ellipsoideae, atro-brunneae, 1-septatae, obtusae, constrictae, echinulate, 20-26.5 X 9.5-12.8 µm. Pycnidia pauca, dispersa, hemisphaeria, stellate dehiscentia ad centrum, irregulariter crenata ad peripherica, ad 100 µm diam.; conidia unicellula, late ovata vel subellipsoidea, atro-brunnea, 14-16 X 9-12.6 µm.

Colonies amphigenous, mostly epiphyllous, black, thin to nearly dense, arachnoid to velvety, up to 5 mm in diameter, rarely confluent. Hyphae brown, substraight to undulate, opposite or irregular branching acutely or lately, loosely or densely reticulate, cells 17-33 X 4.5-5.5 µm. Appressoria unicellular, opposite or 10% alternate, spreading, mostly bent, nearly ellipsoid or cylindrical, 1-3-lobate or rarely angulose, 5-11 X 5-9.5 µm. Ascomata loosely aggregated to scattered, black, orbicular or hemispherical, up to 180 µm in diameter, not pole or opening by a broad or stellately dehiscent pore at central area, irregularly crenate to shortly tasseled at periphery, surface cells 2-3 µm wide; ascospores oblong or ellipsoid, brown, 1-septate, obtuse, constricted at septum, surface echinulate, 20-26.5 X 9.5-12.8 µm. Pycnidia few, similar to ascomata, scattered, hemispherical, black, up to 100 µm in diameter, stellately dehisced at the central, crenate at periphery; conidia unicellular, widely ovate or nearly ellipsoid, brown, 14-16 X 9-12.6 µm.

Holotype: On leaves of *Brucea javanica* (Linn.) Merr.(Simaroubaceae). Longduan, Guangxi Province, China.August 39, 1986, Y. X. Hu, HMIGD 34410.

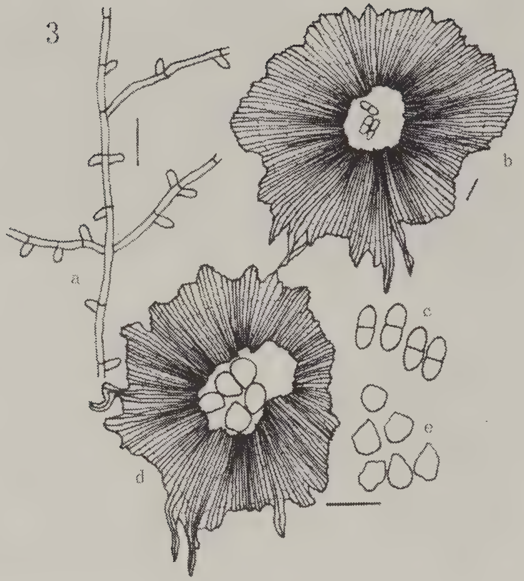
Etymology: *bruceae*, in reference to the host species, *Brucea javanica*.

The present species is closely related to *Asterina lobata* Syd. The distinguishing character of *A. lobata* are that the ascospores are smaller (13-18 X 6-7 µm) and surface smooth; the appressoria are not opposite (Sydow H. et P., 1912a).

3. ***Asterina loropetali*** sp. nov. (Fig. 3)

Coloniae epiphyllae, atrae, tenues, arachnoideae, ad 2.5 mm diam., raro confluent. Hyphae atro-brunneae, subrecta vel sinuata, opposite vel irrugulater acuteque vel wideque ramosae, laxe vel dense reticulatae, cellulis 18-30 X 2.5-3.5 µm. Appressoria uicellula, alternata vel opposita, antrorsa, recta vel leviter sinuata, cylindracea, integra, subacuta vel obtuse ad apice, 6-10 X 3.5-5 µm. Ascomata laxe aggregata vel dispersa, atra, orbiculata vel hemisphaeria, ad 280 µm diam., nulla cava vel stellate dehiscentia ad centrum, irregulariter margina crenata vel fimbriata, cells 2-3.5 µm lata; ascosporae oblongae vel ellipsoideae, atro-brunneae, 1-septatae, obtusae, constrictae, laeves, 22-23 X 9-11.5 µm. Pycnidia numerosus, laxe aggregata vel dispersa, hemisphaeria, stellate dehiscentia ad centrum, irregulariter crenata ad peripherica, ad 170 µm diam.; conidia unicellula, ovata, margina 2-4-angulosa, atro-brunnea, 12-23 X 10-14 µm.

Colonies epiphyllous, black, thin, arachnoid, up to 2.5 mm in diameter, rare confluent. Hyphae brown, nearly straight or sinuous, opposite or irregular branching acutely or lately, closely or densely reticulate, cells mostly 18-30 X 2.5-3.5µm. Appressoria unicellular, in alternate or opposite arrangement, spreading, straight or slightly bent, cylindrical, entire, nearly acute or obtuse at apex, 6-10 X 3.5-5 µm. Ascomata loosely aggregated or scattered, black,



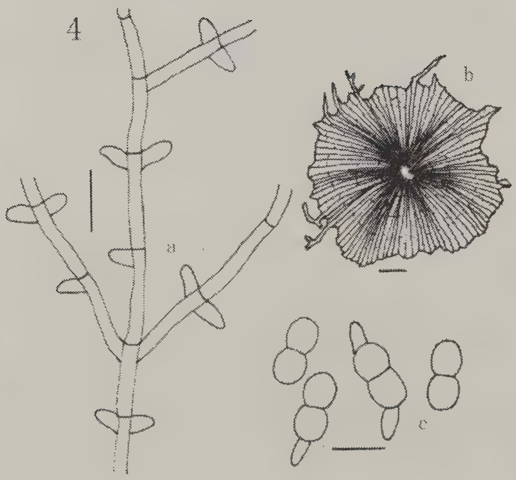


Fig.3 *Asterina loropetali* (a. hyphae with appressoria; b. ascomata; c. ascospores; d. pycnidium; e. conidia). (Bars=25μm).

Fig.4 *Asterina pouteriae* (a. hyphae with appressoria; b. ascomata; c. ascospores). (Bars=25μm).

orbicular or hemispherical, opening by a broad or stellately dehiscent pore at central area, irregularly crenate to shortly tasseled at periphery, up to 280 µm in diameter, surface cells radiated, 2-3.5µm wide; ascospores oblong or ellipsoid, brown, 1-septate, obtuse, constricted at septum, surface smooth, 22-23 X 9-11.5 µm. Pycnidia numerous, similar to ascomata, loosely aggregated or scattered, hemispherical, black, up to 170 µm in diameter, stellately dehisced at the center, crenate at periphery; conidia unicellular, ovate, 2-4-angulose at periphery, brown, 12-23 X 10-14 µm.

Holotype: On leaves of *Loropetalum chinense* (B. Br.) Oliver. (Hamamelidaceae). Guangze, Fujian Province, China.September 8, 1980, Z. X. Chen, HMIGD 34323.

Etymology: *loropetali*, in reference to the host species, *Loropetalum chinense.*

The present species is closely related to *Asterina altingiae* and *Asterina trichocladi* Doidge. The distinguishing character of *A. altingiae* are that the appressoria are bicellular; the distinguishing character of *A. trichocladi* are that the appressoria are alternate, not oppisite (Doidge, 1942).

4. ***Asterina pouteriae*** sp. nov. (Fig. 4)

Coloniae epiphyllae, atrae, tenues, arachnoideae vel subvelvetae, ad 6 mm diam., raro confluent. Hyphae atro-brunneae, subrectae vel rectae, opposite acuteque vel wideque ramosae, laxe vel dense reticulatae, cellulis plerumque 20-50 X 5.5-7 µm. Appressoria uicellula, opposita vel 5-10% alternata, antrorsa, recta vel leviter sinuata, cylindracea vel conoidea, integra, subacuta ad apice, 7-12.5 X 5.5-7.5 µm. Ascomata laxe aggregata, atra, orbiculata vel hemisphaeria, ad 340 µm diam., nulla cava vel stellate dehiscentia ad centrum, irregulariter margina crenata vel fimbriata, cells 2-3 µm lata; ascosporae oblongae vel ellipsoideae, atro-brunneae, 1-septatae, obtusae, penitis constrictae, laeves vel leviter echinulatae, 32-40 X 16-18.5 µm.

Colonies epiphyllous, black, thin, arachnoid to nearly velvety, up to 6 mm in diameter, rare confluent. Hyphae brown, nearly straight to straight, opposite branching acutely or lately, loosely or densely reticulate, cells mostly 20-50 X 5.5-7 µm. Appressoria unicellular, in opposite or 5-10% alternate arrangement, spreading, straight or slightly bent, cylindrical or conoid, entire, nearly acute at apex, 7-12.5 X 5.5-7.5µm. Ascomata loosely aggregated, black, orbicular or hemispherical, up to 340 µm in diameter, opening by a broad or stellately dehiscent at central, irregular crenate to shortly tasseled at periphery, surface cells 2-3µm wide; ascospores oblong or ellipsoid, brown, 1-septate, obtuse, strongly constricted at septum, surface smooth or slightly echinulate, 32-40 X 16-18.5 µm.

Holotype: On leaves of *Pouteria grandifolia* (Wall.) Pierre (Sapotaceae). Menglu, Yunnan Province, China. August 3, 1985, Y. X. Hu, HMIGD 31599.

Etymology: *pouteriae*, in reference to the host species, *Pouteria grandifolia.*

The present species is closely related to *Asterina opaca* Syd. The distinguishing character of *A. opaca* are that the ascospores are smaller (26-28 X 13-14 µm) (Sydow H. et P., 1912b), and it is found mixed with *Meliola butyrospermi* Hansf. et Deight.

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I am deeply grateful to Dr. R. D. Goos of Department of Botany, University of Rhode Island (U.S.A.) for reviewing the manuscript. I also acknowledge Prof. S. Q. Chen of South China Institute of Botany, Academia Sinica (Guangzhou) for identifying the host plant, and to Ms. A.L. Zhang for the technical assistance.

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NEW SPECIES OF PARMOTREMA AND RELICINA (ASCOMYCOTA, PARMELIACEAE) FROM THAILAND

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ABSTRACT: *Parmotrema euplectinum* and *Relicina polycarpa* are reported as new to science. In addition, *Relicina palmata* and *R. subconnivens* are reported for the first time from Thailand.

KEY WORDS: *Parmotrema euplectinum, Relicina polycarpa, Relicina palmata, Relicina subconnivens,* Khao Yai National Park

INTRODUCTION

In recent years there has been a rapid and productive increase in lichenological research in Thailand, especially at the Lichen Research Unit, Ramkhamhaeng University, Bangkok, leading to a much better appreciation of lichen biodiversity with many newly described species (Boonpragob *et al.* 1998; Pooprang *et al.* 1999; Vongshewarat *et al.* 1999; Homchantara & Coppins 2002).

Khao Yai National Park covers 2168 km^2 between latitudes 14°05'N and 14°35'N and longitudes 101°05'E and 101°50'E. Most of the park is occupied by evergreen forest with a microclimate that provides for a high species diversity of tropical lichens. A previous study of lichens in Khao Yai National Park (Boonpragob *et al*., 1998) reported 161 lichenized taxa, with nine genera and fifty-seven species belonging to the Parmeliaceae. The present work describes two further new species of Parmeliaceae from Khao Yai National Park. Chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson *et al.* 1981; Culberson & Johnson 1982; Elix & Ernst-Russell 1993), high performance liquid chromatography (Feige *et al.* 1993; Elix & Wardlaw 2000) and comparison with authentic samples.

THE NEW SPECIES

Parmotrema euplectinum Elix, Noicharoen & Wolseley, sp. nov. Fig. 1

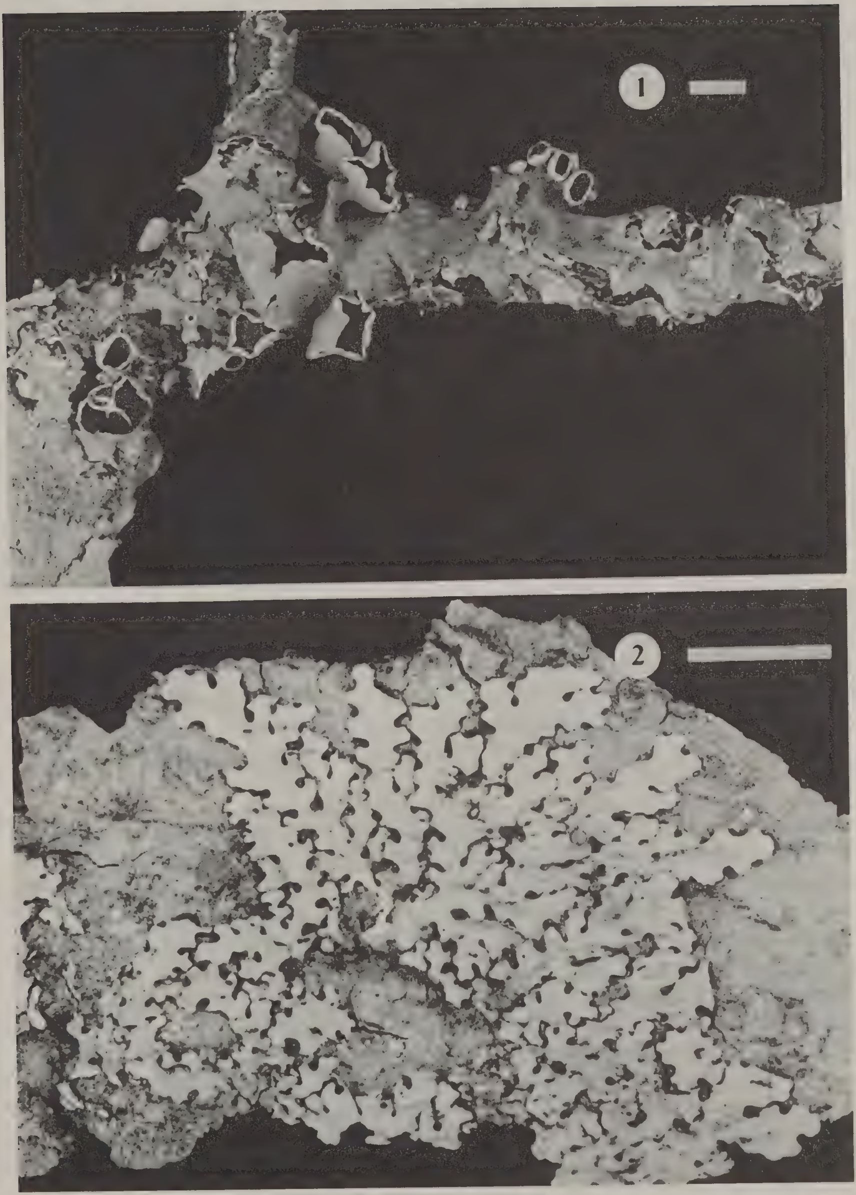
Thallus ut in *Parmotrema thailandicum* sed acidum alectoronicum absente et euplectinum et coneuplectinum continente differt.

Type: Thailand. Uthai Thani Province: Khao Nang Rum Cathouse site, 15°29'N, 99°18'E, 460 m, on bark in dry dipterocarp forest, *B. Aguirre-Hudson, P. James & P. Wolseley 1951,* 10 Feb. 1993; holo: BM; iso: CANB.

Thallus corticolous, foliose, loosely adnate, coriaceous, 8-21 cm wide. *Lobes* rounded or apices irregularly incised, 5-10 mm wide; margins entire or crenate, often ascending; cilia absent. *Upper surface* pale grey to grey-green, shiny, emaculate or faintly maculate, often uneven and wrinkled, cracked with age, soredia and isidia lacking; becoming lobulate-laciniate towards the center; lobulae sublinear to rotund, simple or very rarely branched, 0.8-1.2 mm wide. *Medulla* white for the most part, orange-pigmented adjacent to lower cortex. *Lower surface* black, with a broad, brown erhizinate marginal zone; sparsely rhizinate, the rhizines black, scattered, simple. *Apothecia* pedicellate, 4-10 mm wide; disc eperforate, concave then undulate-distorted and stellate-cracked, dark brown; thalline exciple rugulose with age. Ascospores obovate, 22-24 x 9-11 µm. *Pycnidia* very common, submarginal, immersed to subemergent. *Conidia* sublageniform, 5-7 x 1 µm.

Chemistry. Cortex K+ yellow; medulla K+ pale yellow-brown, C-, P+ red; containing atranorin (minor), chloroatranorin (minor), protocetraric acid (major), euplectin (minor), coneuplectin (minor), virensic acid (trace), subvirensic acid (trace), conprotocetraric acid (trace).

This new species resembles *Parmotrema thailandicum* Elix & Pooprang in both morphology and medullary chemistry; both species have loosely adnate, coriaceous thalli, develop lobulate laciniae towards the centre of the thallus and contain protocetraric in the medulla. However, *P. thailandicum* differs in containing additional alectoronic acid and skyrin in the yellow-orange-pigmented lower medulla (*P. euplectinum* lacks alectoronic acid and contains euplectin and coneuplectin in the lower medulla) and in the longer conidia (7-9 *cf.* 5-7 µm long).



Figures 1-2. New taxa of Parmeliaceae. 1. *Parmotrema euplectinum* (holotype in BM); 2. *Relicina polycarpa* (holotype in RAMK). Scale bar = 5 mm

Specimens examined
THAILAND. Phetchaboon Province, Nam Nao Park, Ranger Station W of Headquarters, on branch in oak-pine forest, *R.J. & A.A. Bandoni & T.W. Flegel 10756*, 19 Sept. 1994 (herb. Diederich); Prachinburi Province, Khao Yai National Park, on summit of Khao Samorpoon Mountain, 14°16'N, 101°36'E, 805 m, on tree in dry dipterocarp forest, *W. Polyiam & K. Noicharoen*, 20 Feb. 2000 (RAMK 17350, 17331, 17333, 17338, 17341).

Relicina polycarpa Elix & Polyiam, sp. nov. Fig. 2

Thallus ut in *Relicina subabstrusa* sed apothecia aggregata et acidum echinocarpicum et acidum normenegazziaicum continente differt.

Type: Thailand. Nakhon Nayok Province: Khao Yai National Park, near sling bridge across Lam Takhong Creek, Kong Keaw Waterfalls, National Park Headquarters, 14°26'S, 101°22'E, 750 m, on branch of *Altingia excelsa* in mid-canopy of tropical rainforest, *K. Noicharoen & W. Polyiam*, 18 June 2000; holo: RAMK 20371; iso: CANB.

Thallus corticolous, small-foliose, adnate, to 2-3 cm wide. *Lobes* contiguous centrally to separate at the periphery, not imbricate, sublinear-elongate, dichotomously to subdichotomously branched, 0.5-1.5 mm wide, elobulate; bulbate cilia moderately dense, conspicuous, strongly inflated, not branched, to 0.3 mm long. *Upper surface* pale yellow-green, flat, smooth, emaculate or faintly maculate, shiny at the apices, without isidia. *Medulla* white. *Lower surface* black; rhizines moderately dense, simple, coarse, black. *Apothecia* aggegated, immersed then sessile, 0.1-0.5 mm wide; disc more or less flat, pale brown, ecoronate; thalline margin absent. Ascospores ellipsoidal, eight per ascus, 7-9 x 5-6 μm. *Pycnidia* rare, immersed. Conidia bacilliform, 7-8 x 1-2 μm.

Chemistry. Cortex K-; medulla K+ yellow-red, C-, P+ orange; containing usnic acid (major), ±atranorin (trace), norstictic acid (major), echinocarpic acid (minor), subnorstictic acid (trace), normenegazziaic acid (trace).

In the morphology of the thallus *R. polycarpa* resembles the widespread species, *Relicina subabstrusa* (Gyeln.) Hale, since both species lack isidia and lobules, have black lower surface and contain norstictic acid as the major medullary substance. However, *R. polycarpa* has aggregated apothecia which lack a thalline margin, and the thallus contains minor quantities of echinocarpic and normenegazziaic acids, whereas *R. subabstrusa* has separate apothecia with a coronate thalline margin and contains minor quantities of connorstictic and ±subnorstictic acids but lacks echinocarpic and normenegazziaic acids (Elix 1996, 1999). *Relicina polycarpa* is unique in this genus in having subimmersed, aggregated apothecia, the disc of which lack a thalline exciple. At present *R. polycarpa* is known only from the type locality.

Specimen examined
THAILAND. Nakhon Nayok Province: Khao Yai National Park, type locality, on fallen twig of *Altingia excelsa* in rainforest, *K. Noicharoen & W. Polyiam*, 18 June 2000 (RAMK 20374).

New Records for Thailand

Relicina palmata Elix, *Bibliotheca Lichenologica* **62**: 83 (1996)

This species was known previously from Malaysia, Philippines and Sri Lanka (Elix 1996).

Specimen Examined

THAILAND. Nakhon Nayok Province: Khao Yai National Park, Training Center, 14°25'N, 101°22'E, 750-900 m, on *Dipterocarpus costatus* in rainforest, *W. Polyiam,* 15 May 2001 (RAMK 21124).

Relicina subconnivens Hale, *Smithsonian Contr. Bot.* **26**: 30 (1975)

This species was known previously from Malaysia (Elix 1996).

Specimens Examined
THAILAND. Nakhon Nayok Province: Khao Yai National Park, Kong Keaw Waterfalls, 14°26'S, 101°22'E, 754 m, on *Altingia excelsa* in rainforest, *K. Noicharoen & W. Polyiam,* 20 Sept. 2000 (RAMK 20370); Khao Yai National Park, Gibbon Camp, tower tree near Visitor Center, 14°26'S, 101°22'E, 750 m, on *Celtis tetrandra* in rainforest, *W. Polyiam,* 20 Sept. 2001 (RAMK 21378).

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NEW AND INTERESTING INOPERCULATE DISCOMYCETES FROM KOREA

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ABSTRACT: Four new species, *Crocicreas albidum* (Helotiaceae), *Trichopeziza juglandis* (Hyaloscyphaceae), *Ciboria salmonea* and *Lanzia eburnea* (Stromatiniaceae) are described from Korea. Six new reports for Korea are provided and their taxonomy is discussed

Key words: taxonomy, new species, biogeography.

The Discomycetes of Korea are poorly known. Only 115 species have been recorded (Lee & Lee, 2000). To produce finally a regional monograph of Discomycetes, the second author started collecting and more than 100 specimens of Discomycetes were collected in 2001. The identification of the specimens was done in collaboration by both authors. We found four new species and six new reports for Korea.

MATERIALS AND METHODS

From July to October 2001, more than 100 specimens of discomycetous fungi were collected in 4 localities in Korea, viz. National Arboretum of Korea (alt. ca. 100 m, Pochon), Daegwanryong Rehabilitation Forest (alt. ca. 400 m, Kangnung), Mt. Chiri (alt. ca. 700 m, Hamyang), and Mt. Halla (alt. ca. 800 m, Cheju). All collections are preserved in the personal herbarium of Ascomycetes of H.D. Shin (MCKU). The holotypes of new species are deposited in the herbarium of the Institute of Zoology and Botany (TAA), isotypes in MCKU.

The dry material was rehydrated in 2% aqueous solution of KOH. Meltzer's reagent (MLZ), Lugol's solution (IKI), Congo Red (CR) and Cotton Blue in lactic acid (CB) were used for histochemical reactions. A Nikon Labophot-2 microscope equipped with a drawing tube was used and all measurements and drawings are made in 2% KOH if not otherwise stated.

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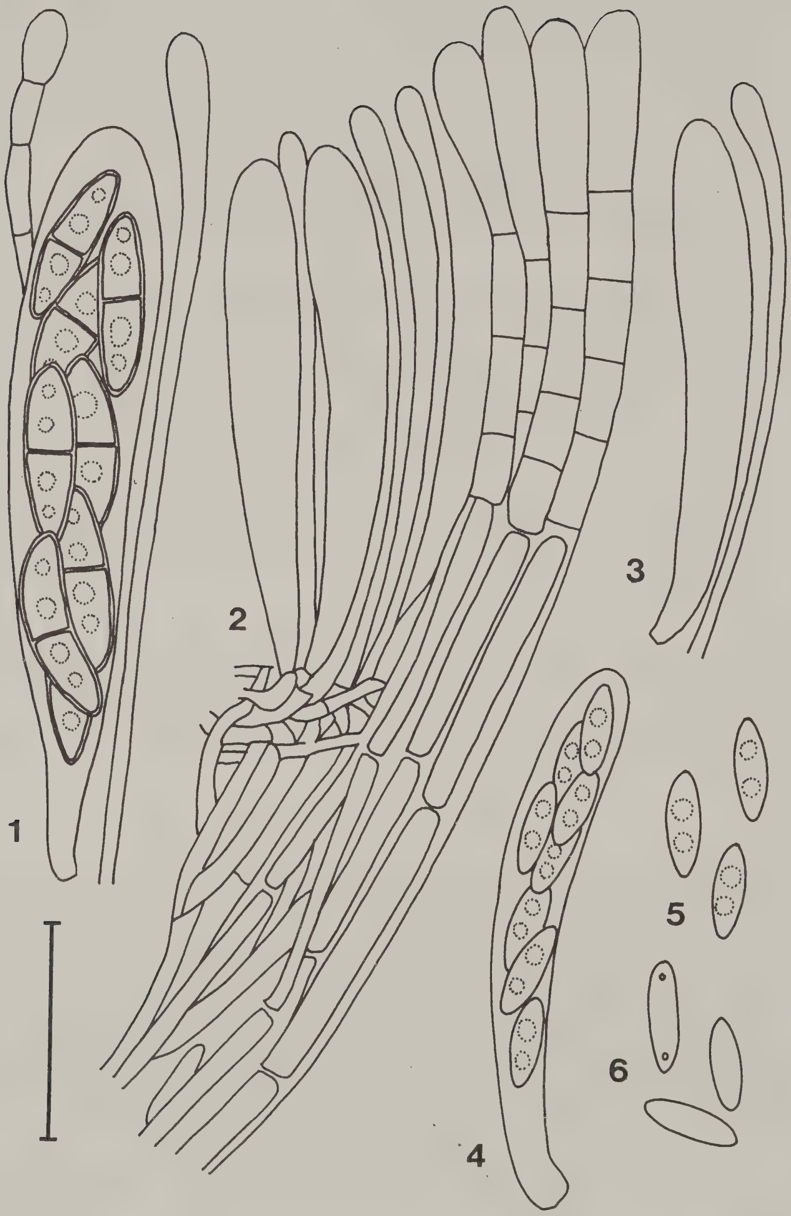


Fig. 1. ***Dactylospora stygia.*** Ascus with paraphyses. **Figs 2-6.** ***Crocicreas albidum.*** 2. Section of an apothecium. 3. Ascus and paraphysis. 4. Ascus with ascospores. 5. Ascospores in KOH. 6. Ascospores in MLZ. Bar = 20µm.

TAXONOMY

Dactylosporaceae

Dactylospora stygia (Berk. & M.A. Curtis) Hafellner, Nova Hedwigia, Beihefte 62: 137, 1979. ASCOCARPS scattered to gregarious, broadly sessile, circular to sub-circular, plane, up to 3 mm in diameter, black and shiny when fresh and dry. EXCIPULUM composed of large, subhyaline to dark brown globose cells changing into small prismatic, blackish brown, sometimes almost opaque cells closer to margin. ASCI clavate, 8-spored, with a thick, rounded apex, 62-80 x (9-)12-15 µm, apex blue, walls red in IKI; apex deep blue, walls colorless in MLZ. ASCOSPORES biseriate or irregularly biseriate, elliptical to irregularly fusiform, uniseptate, smooth or slightly constricted at the septa, 14-20(-24) x 4-6 µm, containing two lipid guttules per cell, light brown to dark olivaceous brown. PARAPHYSES filiform, apically swollen, often with an almost globose apical cell 3-5 µm diam, staining diffusely blue in MLZ, tips encrusted with a brown amorphous matter forming an epithecium. Fig. 1.

Specimens examined: Pochon, Korea, on barkless damp rotten wood, 29 VII 2001, 31 VIII 2001 & 12 X 2001, coll. H.D. Shin, MCKU 010729-2, 010831-1, & 011012-8; Kangnung, Korea, on barkless damp rotten wood, 7 IX 2001 & 5 X 2001, coll. H.D. Shin, MCKU 010907-14 & 011005-17.

Notes: This species of unclear taxonomic position (Kirk et al., 2001) is common in Korea on barkless rotting wood.

Helotiaceae

Crocicreas albidum Raitv. & H.D. Shin species nova

Apothecia solitaria vel dispersa, stipitata, cupulata, albida vel cremea, disco 0.5-2 mm diametro, stipes cylindraceus, tenuis, usque ad 1 mm altus. Excipulum ectale ex textura oblita compositur, hyphis hyalinis. Asci uncinati, cylindraceo-clavati, octospori, 45-50 x 3.5-4.5 µm, poro iodo caerulescentia. Sporae fusoideae, hyalinae, aseptatae, biguttulatae, 8-10 x 2-2.5 µm. Paraphyses cylindraceae, hyalinae, apicibus anguste clavatis, usque ad 2 µm latis.

Ad folia dejecta arborum frondosarum crescit.

Crocicreas espeletarii S.E. Carp. similis, marginem non denticulatum et colorem album differt.

Holotypus: Arboretum Nationale, Pochon, Korea, ad folia caduca, 26 VII 2001, H.D. Shin legit. (TAA-182257 conservatur); isotypus MCKU 010726-3.

APOTHECIA solitary to scattered, stipitate. DISC 0.5-2 mm in diameter, whitish to cream-coloured when fresh and dry. RECEPTACLE cup-shaped, concolorous with the disc, externally smooth. STIPE cylindric, slender, up to 1 mm long. ECTAL EXCIPULUM composed of textura oblita, hyphae more or less parallel, slightly flexuous, embedded in gelatinous matrix, turning into a narrow marginal rim of short-celled textura prismatica and ending in clavate cells with ochraceous, resinous content. ASCI arising from croziers, cylindric-clavate, 8-spored, 45-50 x 3.5-4.5 µm, apical pore blue in MLZ. ASCOSPORES fusoid, hyaline, aseptate, containing two big lipid globules, 8-10 x 2-2.5 µm. PARAPHYSES cylindric, hyaline, apically slightly clavate, up to 2 µm wide. Figs. 2-6.

On fallen leaves of deciduous trees.

Specimen examined: National Arboretum, Pochon, Korea, on fallen leaves of deciduous trees, 26 VII 2001, coll. H.D. Shin, (Holotype in TAA-182257, isotype MCKU 010726-3).

Notes: This small foliicolous *Crocicreas* closely resembles *C. espeletiarum* S.E. Carp. Macroscopically, they differ in the margin and colour of the apothecia (plane vs. denticulate margin and white vs. dark brown colour, respectively). Microscopically, these two species are similar in the excipular structure and hymenial characteristics but they differ in the shape and size of the ascospores. In *C. albidum* the ascospores are fusoid and narrower (2-2.5 µm) containing large lipid globules and in *C. espeletiarum* they are ovoid-ellipsoid and wider (3.5-4 µm) containing small lipid guttules.

Tatraea macrospora (Peck) Baral, Öst. Z. Pilzk. 8: 80, 1999.
= *Ciboria peckiana* (Cooke) Korf, Phytologia 21: 203, 1971
APOTHECIA scattered to solitary, shortly stipitate. DISC 3.5-11 mm in diameter, cream-coloured to light brown when fresh, dark brown when dry. RECEPTACLE cup-shaped when young, becoming plane with age, concolorous with the disc. Stipe cylindric, up to 3 mm long. ECTAL EXCIPULUM composed of textura globulosa, individual cells hyaline, thin-walled. ASCI arising from croziers, cylindric, 8-spored, 143-195 x 11-17.5 μm, short and wide apical pore blue in MLZ. ASCOSPORES fusoid, inequilateral, hyaline, aseptate, containing 1 or 2 large and several small lipid globules, germinating into polar conidia, 26-41 x 5.5-8 μm. PARAPHYSES filiform, septate, hyaline, slightly exceeding the asci, 2-2.5 μm wide.

Specimens examined: Mt. Halla, Cheju, Korea, on rotten wood of *Quercus* sp., 14 VIII 2001, coll. H.D. Shin, MCKU 010814-11 & 010814-15; Kangnung, Korea, on rotten wood of a deciduous tree, 7 IX 2001, coll. H.D. Shin, MCKU 010907-10; National Arboretum, Pochon, Korea, on rotten wood of a deciduous tree, 12 X 2001, coll. H.D. Shin, MCKU 011012-20.

Notes: This widespread species (Spooner, 1987) has recently been transferred to the helotiaceous genus *Tatraea* Svrček by Baral (Baral et al., 1999). It seems to be common in Korea.

Hyaloscyphaceae

Proliferodiscus earoleucus (Berk. & Broome) Haines & Dumont, Mycologia 75: 539, 1983.
APOTHECIA scattered to densely gregarious, sessile, sometimes confluent into compound fruitbodies. DISC up to 1 mm in diameter, pale yellowish when fresh, pale greyish yellow when dry. RECEPTACLE saucer-shaped, externally densely covered with white hairs when fresh, greyish white when dry. ECTAL EXCIPULUM composed of textura prismatica, cells comparatively short, thick-walled. HAIRS flexuous, thick-walled, hyaline, coarsely warted, up to 70 μm long, 2.5-3.5 μm wide. ASCI arising from simple septa, cylindric-clavate, 26-36 x 3.5-4 μm, ascus apex not blued in MLZ. ASCOSPORES ellipsoid, hyaline, aseptate, containing sometimes minute polar lipid globules, 4-5 x 1.2 μm. PARAPHYSES filiform, not exceeding the asci.

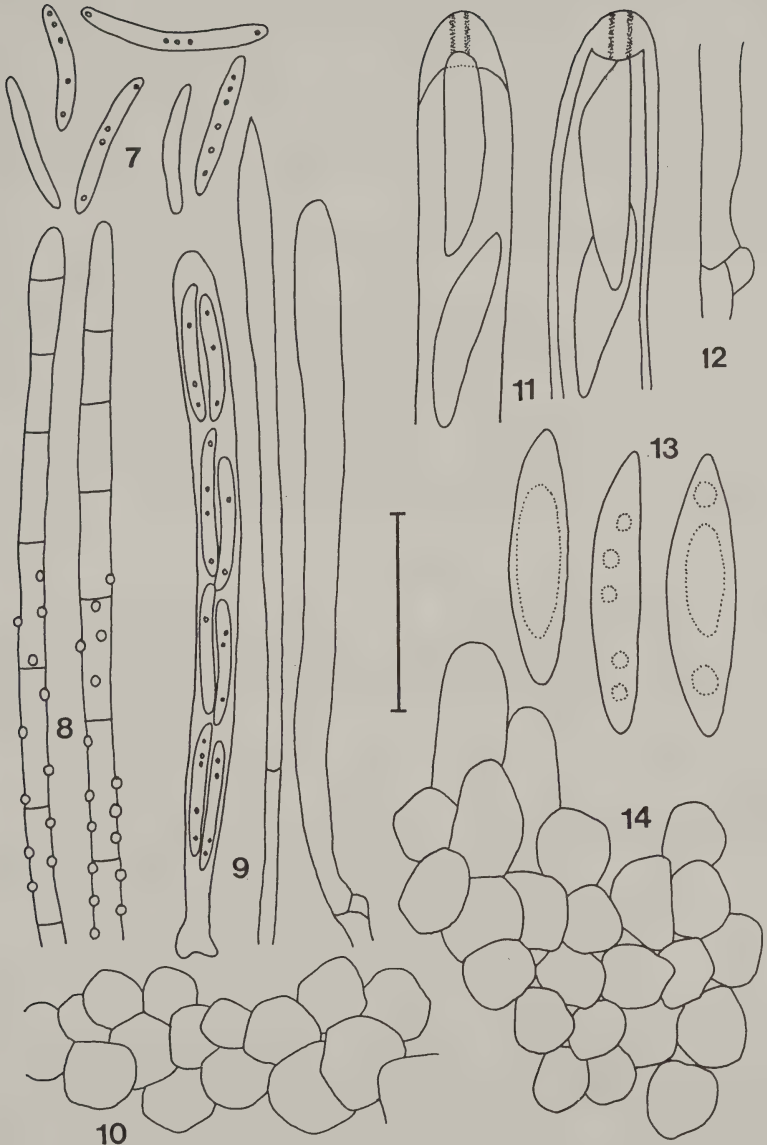
Specimen examined: Mt. Chiri, Hamyang, Korea, on dead branch of *Pinus* sp. (?), 13 VII 2001, coll. H.D. Shin, MCKU 010713-5.

Trichopeziza juglandis Raitv. & H.D. Shin species nova
Apothecia dispersa vel gregaria, late sessilia, applanato-cupulata vel patellaria, 0.5-2 mm diametro, disco luteolo, extus albida, sicca disco ochraceo, extus pallide griseolo, dense longipilosa. Excipulum ectale ex textura angularis-globulosa compositur, cellulis 8-12 μm in diametro, contento purpureo-fusco. Pili cylindracei, multiseptati, subcrassiter hyalinotunicati, basi contento pallide olivaceo-viride, granulis hyalinis delabentibus incrustati, 80-120 x 3-3.5 μm. Asci uncinati, cylindracei, octospori, (85-)90-95(-100) x 5-6.5 μm, poro MLZ+. Sporae biseriatae, hyalinae, cylindraceae, curvatae, aseptatae, minute bi- vel multiguttulatae, (14-)16-21(-24.5) x 1.5-2 μm. Paraphyses anguste lanceolatae, ascos usque ad 15 μm superantes, uniseptatae, 2-3.5 μm in diametro.

Trichopezizae adenostylidis similis, ascis et sporis longis, et excipulo colorato differt.

Holotypus: Arboretum Nationale, Pochon, Korea, ad petiolorum dejectum Juglandis mandschuricae, 12 X 2001, H.D. Shin legit. (TAA-182254 conservatur); isotypus MCKU 011012-4.

APOTHECIA scattered to gregarious, broadly sessile. DISC up to 2 mm in diameter, yellowish when fresh, ochraceous when dry. RECEPTACLE shallow cup-shaped to saucer-shaped, with a raised margin, externally whitish when fresh, greyish when dry, densely covered with long whitish to greyish hairs. ECTAL EXCIPULUM well-developed, composed of textura angularis-globulosa, cells isodiametric, 8-12 μm diam, hyaline, thin-walled, containing dissolved purplish-brown pigment, which may be present also as intercellular exudate, poorly soluble and



Figs 7-10. ***Trichopeziza juglandis.*** 7. Ascospores. 8. Two hairs. 9. Two asci and a paraphysis. 10. Excipular cells. **Figs 11-14.** ***Ciboria fusispora.*** 11. Apical parts of two asci. 12. Ascus base with crozier. 13. Ascospores. 14. A fragment of the ectal excipulum. Bar = 20 µm.

not changing colour in KOH. MEDULLARY EXCIPULUM composed of textura intricata, hyphae thin, densely interwoven. HAIRS long, cylindric, with obtusely rounded to almost conical tips, multicellular, smooth, with hyaline, moderately thick walls, in KOH having pale olivaceous green content in the basal cells, otherwise hyaline, covered with numerous colourless granules which become easily detached, 80-120 x 3-3.5 µm. ASCI arising from croziers, cylindric, 8-spored, apical pore hemiamyloid (type rr) in iodine, always blue in MLZ, (85-)90-95(-100) x 5-6.5 µm. ASCOSPORES biseriate, hyaline, cylindric, curved, aseptate, containing two polar and some dispersed small lipid globules (14-)16-21(-24.5) x 1.5-2 µm. PARAPHYSES narrowly lanceolate, exceeding the asci up to 15 µm, uniseptate, 2.5-3 µm in diameter. Figs. 7-10.

On fallen petioles of *Juglans mandshurica*.

Specimen examined: National Arboretum, Pochon, Korea, on rotting petioles of *Juglans mandshurica*, 12 X 2001, coll. H.D. Shin (Holotype in TAA-182254, isotype MCKU 011012-4).

Notes: *Trichopeziza juglandis* is a peculiar species in the genus *Trichopeziza*. Macroscopically it resembles *T. adenostylidis* (Rehm) Raitv., but differs from it in pigmented excipulum and basally pigmented hairs. The purplish-brown pigment in the excipulum suggests affinities to *T. araliae* Raitv., but in *T. juglandis* the pigment do not dissolve and turn bright green in KOH as in *T. araliae*. In the hair basal cells the pigment, however, turns pale olivaceous green. In such combination of characters *T. juglandis* occupies an intermediate position between white-haired species *T. adenostylidis* and *T. mollissima* and dark-haired species turning green in KOH *T. araliae* and *T. meleagris* (Ellis) Raitv. The long, slender, curved ascospores of *T. juglandis* are unique in the genus. It fruits late in the season and probably for this reason it has been overlooked. It should be looked for in all the area of *J. mandshurica*.

Patellariaceae

Rhytidhysteron rufulum (Spreng.: Fr.) Speg, Anales Soc, Ci, Argent 90:177, 1920.

ASCOMATA gregarious to scattered, elliptic to circular when young, hysteriform to apothecioid at maturity. DISC up to 2 mm in diameter, brownish yellow with dark brown margin and dark brown outer surface. ASCI cylindric, 8-spored, bitunicate, 174-224 x 11-13 µm. ASCOSPORES uniseriate, ellipsoid or oblong, 3-septate, slightly constricted at the septa, obtuse at both ends, dark brown, with slightly granular surface, 28-35 x 10-11 µm. PARAPHYSOIDS filiform, multiseptate, hyaline, blue in MLZ, characteristically swollen at the apex up to 3 µm, forming a reddish epithecium.

Specimen examined: Mt. Halla, Cheju, Korea, on bark of a deciduous tree, 12 VIII 2001, coll. H.D. Shin, MCKU 010812-6.

Notes: This species has been described and discussed in detail by Kutorga & Hawksworth (1997). Our material fits well the description of this variable species, with the asci notably narrower. This is the second report of this species in the Asian continent.

Stromatiniaceae

Ciboria fusispora Spooner, Bibl. Mycol. 116: 312, 1987

APOTHECIA scattered to gregarious, shortly stipitate. DISC 3-5 mm in diameter, saucer-shaped when young, then expanded and flat, yellowish brown when fresh, grayish brown when dry. RECEPTACLE saucer-shaped to disc-shaped, without distinct margin, concolorous with the hymenium when fresh, greyish brown and with strongly incurved margin when dry. ECTAL EXCIPULUM composed of textura globulosa, cells thin-walled, pale brownish. ASCI arising from croziers, cylindric-clavate, 8-spored, 140-160 x 11-14 µm, pore long and blue in MLZ. ASCOSPORES hyaline, ellipsoid-fusoid, with tapered ends, which are rounded in KOH, and somewhat pointed in MLZ,, with one large or 2-3 lipid guttules of different size, 21-31 x 7-8 µm. PARAPHYSES filiform, hyaline, slightly exceeding the asci, with obtuse tips, ca. 1.5 µm wide. Figs. 15-18.

Specimen examined: Kangnung, Korea, on damp rotten wood, 7 IX 2001, coll. H.D. Shin, MCKU 010907-18.

Notes: Baral et al.(1999) suggested that this species might probably belong to *Tatraea*. Our observations show that it has much thicker ascus apex and a longer pore, up to 5 µm long in fully mature ascus, which is clearly different from the shorter and wider pore of *Tatraea* species, and it closely resembles the ascus apical pore in typical members of the Stromatiniaceae.

Ciboria salmonea Raitv. & H.D. Shin species nova
Apothecia dispersa, gregaria vel caespitosa, breviter stipitata, patellaria, 3-6 mm diametro, hymenio salmonea vel pallide brunneo-vinacea, sicca purpureo brunnea vel purpureo fusca, extus cinnamomeo-aurantiaca, sicca fusca. Excipulum ectale ex textura globulosa compositur, cellulis hyalinis usque ad rufo-brunneis. Asci non uncinati, cylindraceo-clavati, octospori, 95-115 x 7.5-10 µm. Sporae uniseriatae, ellipsoideo-fusoideae, inequi-laterales, hyalinae, uniguttulatae, 15-18 x 5-6 µm. Paraphyses filiformes, ad basim ramosae, septatae, apicibus obtusis, 2 µm in diametro.

Ad lignum putridum quercinum crescit.

Ciboriae fusisporae Spooner similis, sporis minoribus differt.

Holotypus: Mons Halla, Cheju, Korea, ad lignum putridum humidum quercinum, 14 VIII 2001, H.D. Shin legit. (TAA-182255 conservatur); isotypus MCKU 010814-19.

APOTHECIA scattered to gregarious or densely clustered, shortly stipitate. DISC 3-6 mm in diameter, flat, salmon-coloured, sometimes with a purplish or brownish vinaceous tint when fresh, purplish brown to dark purplish brown when dry. RECEPTACLE saucer-shaped to disc-shaped, without distinct margin, brownish orange when fresh; with strongly incurved margin and dark brown when dry. ECTAL EXCIPULUM 50-80 µm thick, composed of textura globulosa, cells 7.5-14 µm in diameter, hyaline to reddish-brown. Outer surface of ectal excipulum covered with short triangular tufts of dark brown hair-like hyphae. MEDULLARY EXCIPULUM 50-60 µm thick, composed of hyaline textura porrecta. ASCI arising from simple septa, cylindric-clavate, 8-spored, 110-115 x 7.5-10 µm, with a long and narrow pore blue in MLZ. ASCOSPORES uniseriate, hyaline, ellipsoid-fusoid, mostly inequilateral, with tapered ends rounded in KOH, and slightly pointed in MLZ, containing one large lipid globule, 15-18 x 5-6 µm. PARAPHYSES filiform, hyaline, branched at the base, septate, obtuse at the end, ca. 2 µm wide. Figs. 15-18.

On rotten wood of *Quercus* sp.

Specimen examined: Mt. Halla, Cheju, Korea, on damp rotten wood of *Quercus* sp., 14 VIII 2001, coll. H.D. Shin (Holotype TAA-182255, isotype MCKU 010814-19).

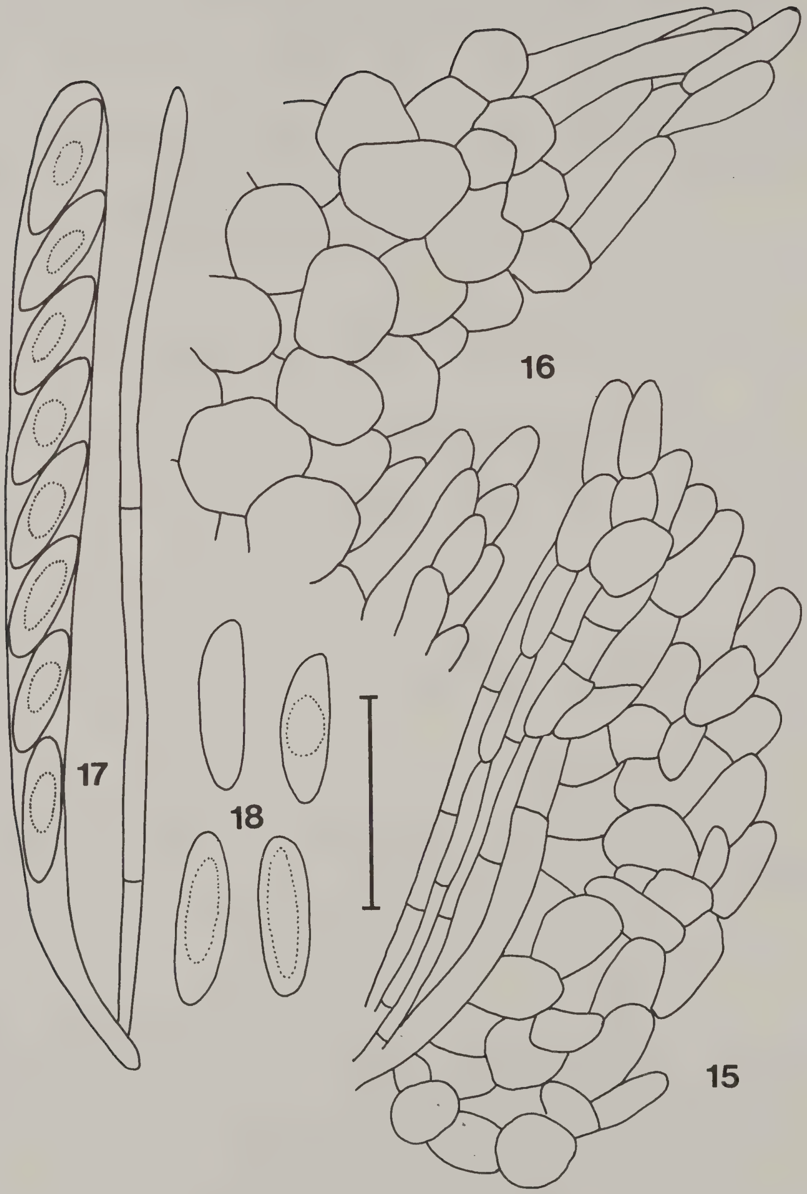
Notes: *Ciboria salmonea* is similar to *C. fusispora* Spooner. Macroscopically, it differs from the latter in bigger apothecia which have vinaceous to purplish tint. Microscopically, the ascospores of *C. salmonea* are considerably smaller.

Dicephalospora rufocornea (Berk. & Broome) Spooner, Bibl. Mycol. 116: 272, 1987.

APOTHECIA scattered, stipitate. DISC 1-3 mm in diameter, yellow, saucer- shaped to nearly flat. RECEPTACLE cupulate to discoid, yellowish orange, smooth. STIPE central, 1-2 mm long, cylindric or slightly tapered at the base, concolorous with the receptacle, base black. ASCI arising from small inconspicuous croziers, cylindric, 8-spored, 122-146 x 9-12 µm, apical pore blue in MLZ. ASCOSPORES biseriate or irregularly biseriate, 28-50 x 4-5 µm, hyaline, containing a row of large lipid guttules, slightly curved, cylindric-fusoid, with an obconical gelatinous collar at the ends. PARAPHYSES hyaline, filiform, slightly exceeding the asci, ca. 2 µm wide, slightly enlarged at the apex, often branched at the lower part. ECTAL EXCIPULUM composed of textura prismatica, cells hyaline, thick-walled.

Specimens examined: Mt. Chiri, Hamyang, Korea, on dead branch of a deciduous tree, 13 VII 2001, coll. H.D. Shin, MCKU 010713-1; National Arboretum, Pochon, Korea, on dead branch of a deciduous tree, 26 VII 2001, coll. H.D. Shin, MCKU 010726-1.

Notes: This conspicuous species on forest debris is common and abundant in Korea, probably the most common species of Helotiales. It has a rather complicated nomenclatural history

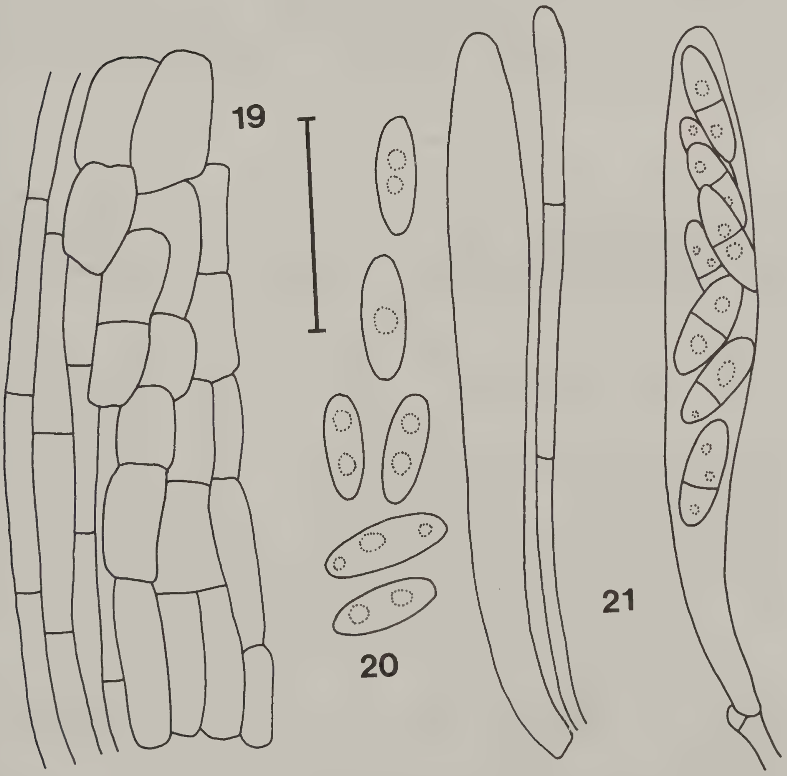


Figs 15-18. ***Ciboria salmonea*** 15. Excipulum at the margin of apothecium. 16. Excipulum at the flanks of apothecium. 17. Ascus and paraphysis. 18. Ascospores. Bar = 20 µm.

(Dumont, 1980) and we agree with Spooner (1987) that it should be placed in the genus *Dicephalospora* Spooner. The ascus and spore size is very variable and the Korean material differs slightly from Australasian material (Spooner, 1987) by having shorter asci and longer ascospores but agrees with Dumont (1980).

Lanzia eburnea Raitv. & H.D. Shin species nova

Apothecia dispersa, gregaria vel caespitosa, breviter stipitata, vadoso infundibuliformia, 1-2 mm diametro, tota albida. Stipes obconicus, basi nigrificatus. Excipulum ectale ex textura prismatica compositur, cellulis hyalinis, subcrassiter tunicatis, 10.5-16.5 x 5-10 µm. Asci uncinati, cylindraceo-clavati, octospori, 65-80 x 9-12.5 µm. Sporae uniseriatae vel biseriatae, ellipsoideae, hyalinae, minute biguttulatae, 9-14 x 3.5-5 µm. Paraphyses filiformes, septatis, apicibus obtusis, 2-2.5 µm in diametro.



Figs 19-21. *Lanzia eburnea.* 19. A fragment of excipulum. 20. Ascospores. 21. Two asci (left in KOH, right in MLZ) and a paraphysis. Bar = 20 µm.

Ad lignum putridum frondosarum crescit.

Lanziae albo-atrae (P. Hennings) Dumont similis, ascis brevibus, apotheciis non nigrescentibus et substratis lignicolis differt.

Holotypus: Kangnung, Korea, ad ramum putridum frondosarum, 19 X 2001, H.D. Shin legit. (TAA-182256 conservatur); isotypus MCKU 011019-10.

APOTHECIA arising from small stromatic patches in substrate, scattered to gregarious or clustered, stipitate. DISC 1-2 mm in diameter, snow-white. RECEPTACLE shallow funnel-shaped, white. STIPE short, up to 1 mm long, obconical, white with a blackish base. ECTAL EXCIPULUM composed of textura prismatica, cells hyaline, firm-walled, 10.5-16.5 x 5-10 µm. ASCI arising from croziers, cylindric-clavate, 8-spored, 65-80 x 9-12.5 µm, apical pore faintly blue in MLZ. ASCOSPORES uniseriate or irregularly biseriate, ellipsoid, hyaline, containing two small polar or several lipid guttules, becoming 1-septate at maturity, 9-14 x 3.5-5 µm. PARAPHYSES filiform, obtuse at the end, hyaline, 2-2.5 µm wide, septate. Figs. 19-21.

On rotting deciduous wood.

Specimen examined: Kangnung, Korea, on rotting branch of a deciduous tree, 19 X 2001, coll. H.D. Shin (Holotype TAA-182256, isotype MCKU 011019-10).

Notes: The closest species to *Lanzia eburnea* is *L. albo-atra* (P. Hennings) Dumont described as ocurring on fallen leaves from South Brasil (Dumont, 1981). They are similar in the structure of ectal excipulum and spore shape. L. eburnea has, however, considerably shorter asci, smaller ascospores, apothecia remaining white when dry, and it grows on wood.

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A NEW SPECIES OF MEMNONIELLA FROM INDIA

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ABSTRACT

A new species of Hyphomycetes, *Memnoniella indica*, isolated from decaying leaves of an unidentified dicot plant from the forests of Andaman Islands, India, is described and illustrated. The fungus produces catanulate, globose, verruculose, dark brown conidia on monophialidic, discrete, hyaline conidiogenous cells and short, partly hyaline, determinate, branched, septate, mononematous conidiophores. It is distinguished from the known species of *Memnoniella* on the basis of morphology and dimension of conidiophores and conidia. A key to the species of *Memnoniella* is given.

Key words: tropical fungi, hyphomycetes, Andaman Islands, biodiversity

INTRODUCTION

During studies on the taxonomy and diversity of microfungi of the forests of India, an interesting hyphomycete producing dark brown, verruculose, aseptate, spherical conidia with a hyaline minute basal papilla, developing on monophialidic, discrete, hyaline conidiogenous cells and short, partly hyaline, thick-walled, septate, branched, mononematous conidiophores was isolated in culture from fallen and decaying leaves of an unidentified dictot plant from the forests of Andaman Islands, India. The fungus is described here as a new species of the genus *Memnoniella* Hohnel.

Litter samples collected from the forests of Andaman Islands were air-lifted to Goa and immediately incubated in sterile moist chambers in the laboratory for about two weeks. Pure culture of the fungus was established by single spore isolation on to malt extract agar medium. The sporulating colonies of the fungus were mounted in lactophenol, examined under an Olympus bright field research microscope, and illustrated using a drawing tube fitted to the microscope unit.

TAXONOMIC PART

Memnoniella indica **sp. nov.** (Fig.1)

Ad fungos conidiales pertinens. *Coloniae* effusae, cum rotundus marginis, subhyalina ad brunneae, usque 3 cm in MEA in 7 dies. *Mycelium* partim superficiale, partim immersum, ex hyphis septatis, ramosis, hyalinis vel pallide brunneis 2.5-3.5 µm lat. compositum. *Conidiophora* mononematosa, erecta, septata, ramosa, crassitunicata, infra hyalina et levia ad supra pallide fusca et verruculosa, 35-75 µm longa, 5-5 µm lat. ad basim, 3-4 µm ad ramosis et usque 1 µm ad extremum distalis; *Cellulae conidiogenae*

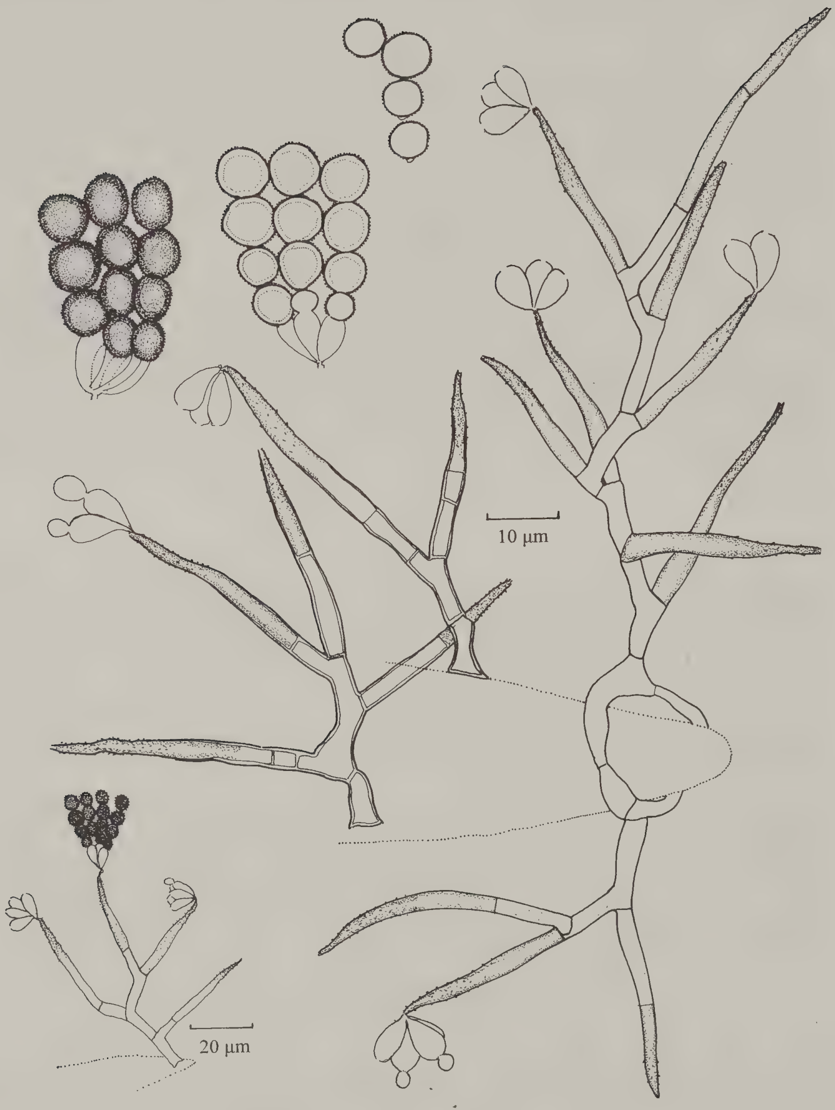

Fig. 1. *Memnoniella indica* **sp. nov.:** a. Branched conidiphores with conidia, b. Conidiogenous cells with attached conidial chains, c. Conidia.

monophialidicae, discretae, terminalis, ellipsoidea ad pyriforma, levis, hyalina ad atrobrunnea, 5-10 x 5-7 µm. *Conidia* catenata, globosa, aseptata, verrucosa, crassitunicata, atrobrunnea to nigra, 5-6 µm in diam.

HOLOTYPUS, In foliis putrescentibus dicota, Andaman Islands, India, 20th January 2001, leg. Rajiv Kumar, Herb. No. IMI 389316.

Terrestrial litter hyphomycete. *Colonies* effuse, flat, with a circular margin, subhyaline to brown, attaining a diam. of 3 cm on MEA after 7 days. *Mycelium* partly superficial, partly immersed, composed of septate, branched, colourless to pale brown hyphae 2.5-3.5 µm wide. *Conidiophores* mononematous, erect, septate, branched, thick-walled, colourless and smooth below and slightly pigmented and minutely verrucose in the above half, with the tip of the stipe tapering into a pointed and fragile end on which groups of 3-7 phialides arise, 35-75 µm long, 3.5-5 µm wide at the base and up to1 µm at the pointed end. *Conidiogenous cells* monophialidic, discrete, terminal, 3-7 on each conidiophore tip, ellipsoidal to pyriform, without collarette, smooth, hyaline, 5-10 x 5-7 µm. *Conidia* catenate, spherical, with a minute basal papilla, aseptate, verrucose, thick walled, dark brown to black, 5-6 µm in diam.

The genus *Memnoniella* Hohnel, typified by *M. echinata* (Riv.) Galloway, is characterized by production of catenate, simple, spherical to sub-spherical, grey to black conidia on discrete phialides, usually with a small opening and without a collarette, in groups of up to 10 at the apices of mononematous, unbranched and occasionally forked conidiophores which are sometimes inflated at the apex, grey to brown, smooth, minutely verruculose and often covered in part with dark granules (Ellis, 1971).

In addition to the type, 5 species of *Memnoniella* have been described. *M. stilboidea* (Munjal & Kapoor) M.B. Ellis and *M. leprosa* Castaneda possess scattered synnema whereas all the other species have mononematous conidiophores. While the former produces verruculose dark brown to blackish brown spherical conidia of 4-5.5 µm, the latter gives rise to 7-12 µm globose conidia with an upper dark brown thick-walled portion and lower pale to olivaceous brown comparatively thin-walled region (Ellis, 1976; Castaneda, 1986). Ellis (1971) maintained *M. echinata* and *M. aterrima* Hohnel & Mazzuchetti as synonyms. *M. zingiberis* Vasant Rao with verrucose dark conidia of 4-7 µm differs from *M. echinata* in having very short conidiophores and more phialides, besides being a pathogen on rhizomes of *Zingiber officinale* Rose (Rao, 1963). *M. subsimplex* (Cooke) Deighton produces spherical to sub-spherical, dark brown, verrucose (with widely spaced large warts), 6-9 µm diam. conidia. *M. levispora* Subram. produces smooth and 4-6 µm diam. conidia. *M. indica* produces catenate conidia on thin-walled phialides which often hang or swivel on thick-walled, branched condiophores with pointed tips.

A taxonomic key is proposed to delineate species of the genus ***Memnoniella.***

1. Conidiomata synnematous……………………………...…………………….……2
1. Conidiomata mononematous…………………………………...……………..…3

2. Conidia verruculose, 4-5.5 µm-- ***M. stilboidea***
2. Conidia verrucose, leprose, 7-12 µm--***M. leprosa***

3. Conidia 6-9 µm in diam.-- ***M. subsimplex***
3. Conidia less than 6 µm in diam……………………………………………………4

4. Condia smooth, 4-6 µm--- ***M. levispora***
4. Condia verrucose..5

5. Conidiophore tip tapered to a narrow point--------------------------------------***M. indica***
5. Condiophore tip inflated...6
6. Conidiophore 50-100 µm, Phialides in groups of 4-8,
7-9 x 3-5 µm --------------------------***M. echinata* (=*M. aterrima*)**
6. Conidiophore 37-50 µm, Phialides in groups of 8-14,
6.3-14.7 x 4.2-5.2 µm ---------------------------------------***M. zingiberis***

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SAPROBIC FUNGI ON DEAD WILD BANANA

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Abstract Saprobic fungi associated with dead tissue of *Musa acuminata* from five sites at Doi Suthep Pui National Park, Thailand were investigated. Nine hundred collections of decaying *Musa* were examined and 80 fungal species were identified, comprising 7 ascomycetes, 2 basidiomycetes and 71 anamorphic fungi (4 coelomycetes and 67 hyphomycetes). The most commonly encountered species were *Periconia digitata*, *Verticillium tenuissimum*, *Memnoniella subsimplex* and *Pseudobotrytis terrestris*, which were represented by 32%, 19%, 15% and 14% of the total collections, respectively. The site of collection did not significantly affect fungal species composition. However, the fungal communities on leaves were markedly different from those on petioles and pseudostems.

Keywords ascomycetes; basidiomycetes; biodiversity; anamorphic fungi; *Musa acuminata*.

Introduction

Several taxonomic studies have been carried out of fungi on banana (e.g. Matsushima, 1971; Photita *et al.*, 2001a) including endophytic fungi (Brown *et al.*, 1998; Photita *et al.*, 2001b). Photita *et al.* (2001a) examined fungi on *Musa acuminata* in Hong Kong and provided an annotated checklist of all fungi described from the *Musaceae* (Photita *et al.*, 2001c). Recent intensive studies of microfungi on plants in the tropics have included those on bamboo (Hyde *et al.*, 2001), palms (Hyde & Alias, 2000), grasses (Wong & Hyde, 2001) and *Pandanaceae* (Whitton *et al.*, 1999a, b; 2000a,b; 2001) and these provide important data for the "fungal estimates" debate (Hawksworth, 1991; Hyde 2001). The present study was initiated in order to complement these studies by examining and comparing the fungi on a herbaceous host, *Musa acuminata* in different tissues and different sites at Doi Suthep Pui National Park, Thailand.

Materials and Methods

Nine hundred samples of dead banana tissue were collected from four sites at Doi Suthep Pui National Park: Ban Suthep (site1, 350 m above sea level), Montatarn waterfall (site2, 600 m above sea level), Medicinal Plant Garden (site3, 1200 m above sea level), San Gu Region (site4, 1400 m above sea level), and one site at Queen Sirikit Botanic Garden (site5, 600 m above sea level). Samples were collected from each site every three months during 1999 to 2000. At each sampling period and each site, 10 randomly selected decaying leaf (10 × 10 cm), 10 decaying petiole and 10 decaying pseudostem samples (each 10 cm long) were collected from different individual banana plants. A three dimensional correspondence ordination analysis was performed to examine the difference in fungal taxa and communities from different sites and tissue types.

Each piece of petiole, pseudostem and leaf was placed in an individual plastic box, incubated in the laboratory and examined within one week of collection.
The fungi were identified to species level where possible using standard literature, e.g. Ellis (1971, 1976) and Sutton (1980). Herbarium material is deposited at Chiang Mai University (CMU) and Landcare Research herbaria (PDD) and cultures are deposited at Biotech Culture Collection.

Results

Eighty fungal species were identified, comprising 7 ascomycetes, 2 basidiomycetes and 71 anamorphic fungi (4 coelomycetes and 67 hyphomycetes) (Table 1). The most common species were *Periconia digitata* (on 32% of samples), *Verticillium tenuissimum* (19%), *Memnoniella subsimplex* (15%) and *Pseudobotrytis terrestris* (14%). *Periconia digitata* was the most common species on banana samples from site3, site4 and site5, being found on 50%, 25% and 50% of samples, respectively. *Zygosporium oscheoides* was the most common species from site1, while *Verticillium tenuissimum* was the most commonly encountered species from site2.

Overlap of taxa from the five sites was 24% (Table 1) with 16 species being found at all sites. Basidiomycete sp. 1, *Diplodia* sp., *Eupenicillium* sp. and *Tetraploa aristata* were found only at site1; *Stachybotrys nephrospora* was found only at site2; *Colletotrichum musae*, *Cordana musae*, *Helminthosporium velutinum*, *Pseudocercospora* sp. and *Sporidesmium aquaticum* were found only at site3; *Ophiobolus* sp., Hyphomycete sp. 5 and *Sporoschisma saccardoi* were found only at site5; and Basidiomycete sp. 2 was found only at site4.

Results of the three dimensional correspondence analysis are shown in Figure1. Percentage of total variance explained by the model is 87 %. The site of collection did not significantly affect fungal species compositions. However, tissue types was found to have the strongest influence on the fungal communities. This is indicated by clusters formed by samples on the leaves, petioles and pseudostems (Fig. 1). The fungal communities on leaves were markedly different from those on petioles and pseudostems, indicated by the separation of leaf sample fungi to the left of Fig. 1. *Anthostomella clypeoides*, *Cladosporium cladosporioides*, *C. musae*, *Exserohilum* cf. *halodes*, *Hansfordia ovalispora*, *Helminthosporium velutinum*, *Mycosphaerella* sp., *Periconia lateralis* and *Pseudocercospora* sp. were found only on leaves. The fungi on the petioles and pseudostems were more similar to each other, than those on the leaves, fungal communities but they also formed distinct communities (circled in Fig. 1). *Colletotrichum musae*, *Hemicorynespora mitrata* and *Helicomyces macrofilamentosus* were found only on petioles, while *Eupenicillium* sp. and *Dictyosporium heptasporum* were found only on pseudostems (Table 1).

While most of the fungi can be regarded as saprobes, several species, which are weak pathogens on banana, were found to persist as saprobes on the dead banana tissues. These include *Cladosporium musae*, *Cordana musae* and *Periconiella musae*.

Discussion

Biodiversity and host specificity

In this study, 80 taxa of fungi were identified on 900 samples of *Musa acuminata* collected in Thailand. The data can be compared with results from a similar study in Hong Kong, where Photita *et al.* (2001a) identified 46 fungi from a total of 1125 samples (375 leaves, 375 petioles and 375 pseudostems) of the same host. The overlap in taxa occurring on *M. acuminata* in Hong Kong and Thailand is low at 12%. Fifteen fungal species have also been identified on *M. acuminata* and four on *M. paradisiaca* in Papua New Guinea and the Solomon Islands (Matsushima, 1971). Only three of these species were also found in the present study. The data suggests that the fungi involved in the degradation of *M. acuminata* plant organs may differ from one country to another.

The fungi recorded on *M. acuminata* in Thailand can also be compared with those recorded on other monocotyledous plants. Fröhlich & Hyde (1999) identified 242 fungal taxa from six individual *Licuala ramsayi* palm from Australia. Only one of these taxa was found on *M. acuminata* in the present study. Yanna *et al.* (2001b) found 288 fungal taxa on various decaying palm fronds in Australia, Brunei and Hong Kong, while Hyde *et al.* (2001) identified 82 taxa from bamboo culms. Two and nine taxa, respectively, recorded in these studies were also found in the present study. Wong & Hyde (2001) identified 195 taxa from six grass and one sedge species in Hong Kong and 16 species overlapped with the present study. With the exception of bamboo samples, the fungal diversity on banana is generally lower than on other monocotyledonous hosts. This may be due to the herbaceous nature of the banana tissues. Wong & Hyde (2001) found that grasses offering more durable, strongly sclerenchymatous substrata (i.e. woody) tended to support a higher fungal diversity. Hyde *et al.* (1997) also reported similar trends in palms and this has also been reported for other plants (Jones *et al.*, 1988; Sadaba *et al.*, 1995).

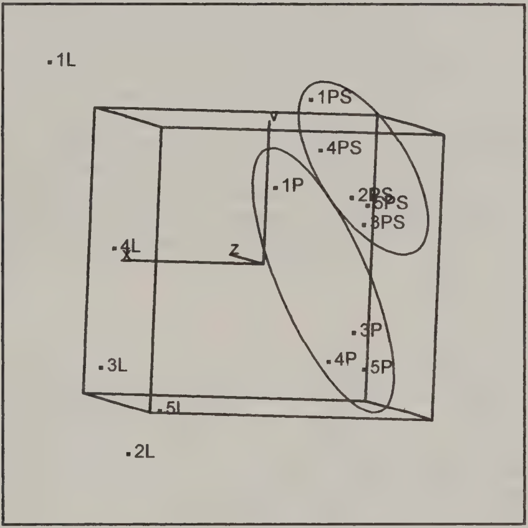

Fig. 1. Three dimensional correspondence ordination of taxa and fungal communities recorded from leaves (L), petioles (P) and pseudostems (PS) of *Musa acuminata* from five sites (Site1, 2, 3, 4, 5) at Doi Suthep Pui National Park.

The overlap of fungi occurring on *M. acuminata*, with those recorded from other hosts is low. This may be influenced by climate and geographical distribution, and/or host-specificity and host-recurrence of the fungi (Zhou & Hyde, 2001). Saprobic fungi are unlikely to be host specific and, therefore, host specificity is unlikely to influence saprobic fungal diversity. An important factor that may influence the biodiversity of saprobic fungi on various hosts is therefore host-recurrence. The reasons as to why fungi may occur recurrently on certain hosts is not understood, but may be related to the presence of these fungi as endophytes.

Tissue specificity

Different fungal communities were found on leaves, petioles and pseudostems of dead banana. The recurrence of fungi on certain tissue types has also been shown with palms (Yanna *et al.*, 2001a,b). The petioles of palms differ from the leaves as they have more concentrated supportive tissue and the outer region is composed of a sclerenchyma with associated bundles (Tomlinson, 1990). These structural differences may account for the fungi confined to specific tissues as some fungi may have enzyme systems that can degrade the sclerenchyma tissues containing lignin, while others only degrade cellulose.

Fungal tissue recurrence has also been reported with other hosts (Hyde *et al.*, 1994; Poon & Hyde, 1998; Yanna *et al.*, 2001a,b). Poon & Hyde (1998) found that fungi on *Phragmites australis* were vertically distributed. There were more ascomycetes on the lower culm tissues comprising sclerenchyma, and more anamorphic taxa on the upper herbaceous tissues. This may however, have been influenced by moisture as the bases were submerged. Sadaba *et al.* (1995) found different fungal communities on herbaceous and woody parts of *Acanthus ilicifolius* (*Acanthaceae*), more ascomycetes occurring on the lower woody part and more anamorphic taxa on the upper herbaceous parts. The preference of certain fungi for different tissue types may be due to differences in nutritional requirements, or the ability of the fungi to utilize different substrates (Adaskaveg *et al.*, 1991; Ingold & Hudson, 1993). Alternatively, it may be related to the distribution of endophytes, a theory which requires testing. Unfortunately most endophytes are common coelomycetes such as *Colletotrichum* spp., or sterile mycelia and it not possible at this stage to compare the results with those of Photita *et al.* (2001b). The enzymatic activities of these fungi also warrants further investigation in order to understand whether their abundance on specific tissue types is due to differing enzymatic capabilities (Yanna *et al.*, 2001a,b).

Abundance of anamorphic fungi

Anamorphic fungi were the most frequently recorded taxa at all sites. Several hyphomycetes encountered in this study have been previously recorded on *Musa* species (Ellis, 1971, 1976; Matsushima, 1971; Photita *et al.*, 2001c). These fungi can also occur on large woody monocotyledons, e.g. *Pandanaceae* (McKenzie & Hyde, 1997). Anamorphic taxa were also the most frequently recorded fungi on other monocotyledonous hosts (e.g. bamboo; Hyde *et al.*, 2001; grasses, Wong & Hyde, 2001; palms; Yanna *et al.*, 2001a,b).

Banana plant tissues are herbaceous and decay rather quickly. The fungi on banana tissues therefore need to sporulate rapidly in order to disperse their spores before the tissues completely break down. Anamorphs generally sporulate more quickly than teleomorphs. Both black sigatoka (*Mycosphaerella fijiensis*) and yellow sigatoka (*Mycosphaerella musae*) disease of banana produce the anamorph on banana tissues several days before the teleomorph (Stover, 1980). Most anamorphic taxa will usually sporulate in culture within one week to a month, while the teleomorph may take considerably longer or often fails to sporulate (Hyde *et al.*, 1987). This may account for the dominance of anamorphic taxa found on herbaceous tissues in this study.

Plant pathogens

Some fungi, e.g. *Cladosporium musae*, *Colletotrichum musae*, *Cordana musae*, *Deightoniella torulosa* and *Periconiella musae*, which are believed to be banana pathogens (Holliday, 1980) were identified as saprobes in this study. Some saprobes can also be facultative parasites.

Fungal numbers

Estimates of fungal diversity are important in order to appreciate the value of threatened natural habitats. Hawksworth (1991) used amongst other data, a ratio of approximately six fungal species to every vascular plant species in order to estimate fungal species numbers worldwide. The figure of 1.5 million used data from comparatively well-known temperate ecosystems, but recent data from the tropics (e.g. Fröhlich & Hyde, 1999; Wong & Hyde, 2001; Yanna *et al.*, 2001a,b) appear to support these estimates.

In the present study there was low overlap between species (24%) at the five sites studied and this has important implications for diversity estimates as different fungi were found at different sites. Site III had the highest number of fungal taxa. This might be related to the density of forest, and consequently all year round high humidity (80-90%). Differences in

Table 1. Frequency of fungal species, found on petioles (P), pseudostems (Ps) and leaves (L) of *Musa acuminata* from five sites at Doi Suthep Pui National Park, Thailand.

Taxa	Site 1 [(a)]			Site 2			Site 3			Site 4			Site 5			Percentage occurrence
	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	
Acremonium sp.			3				1									0.44
Alternaria alternata (Fr.) Keissler		2										1				0.33
Anthostomella clypeoides Rehm						16			12			6		2	9	5.00
Arthrobotryum sp.														1		0.11
Aspergillus flavus Link										1						0.11
Basidiomycete sp. 1	1															0.11
Basidiomycete sp. 2													1			0.11
Berkleasmium phyllostachydis Matsush.					1											0.11
Canalisporium caribense (Hol.-Jech. & Mercado) Nawawi & Kuthub.		1		11	17		8	25	3	2	18		7	13		11.67
Chaetomium sp.	1		4	1			2	1	7	6		18	2	1		4.77
Chloridium sp.	1		1	2	3	1	4					4				1.78
Cladosporium cladosporioides (Fresen.) G.A.de Vries[#]			14		1	4			21			6			8	6.00
Cladosporium musae E.W. Mason[#]									1			1			1	0.33
Cladosporium oxysporum Berk. & M.A. Curtis[#]									1			1			1	0.33

Table 1. *Cont.*

Taxa	Site 1			Site 2			Site 3			Site 4			Site 5			Percentage occurrence
	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	
Colletotrichum musae (Berk. & M.A. Curtis) Arx	2						2									0.44
Cordana musae (Zimm.) Höhn.#						4										0.44
Corynespora cassiicola (Berk. & M.A. Curtis) C.T. Wei											1			1		0.22
Curvularia geniculata (Tracy & Earle) Boedijn									1							0.11
Cylindrocarpon sp.		2	1	2	2	2	1	1		1			8		1	3.44
Dactylaria dimorphospora Veenb.-Rijks	1	2					1	1								0.56
Dactylaria sp. 1*		2		1	6		3	1								1.44
Dactylaria sp. 2*															1	0.11
Dactylella rhombica Matsush.	1	7	1	1			2			2	1					1.67
Dactylella sp.				1	5											0.67
Deightoniella torulosa (Syd.) M.B. Ellis#	13	4	28	1								7		1		6.00
Dictyoarthrinium sacchari (J.A. Stev.) Damon		1			1	1				2	2		4	4		1.67
Dictyochaeta sp.*							1	2	1				2	2		0.89
Dictyosporium heptasporum (Garov.) Damon	1				1		1									0.33
Diplococcium capitatum Piroz.		6		3	6		1	4								2.22

Table 1. *Cont.*

Taxa	Site 1			Site 2			Site 3			Site 4			Site 5			Percentage occurrence
	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	
Diplodia sp.	1												1			0.22
Eupenicillium sp.		1	1													0.22
Exserohilum halodes (Drechsler) K.J. Leonard & Suggs									3		2					0.56
Fusarium sp.1					1	2			2			1	1			0.89
Fusarium sp.2								6					1		1	0.78
Gliomastix sp.*													2			0.22
Graphium sp.								3								0.33
Hansfordia ovalispora S. Hughes			2						1						3	0.67
Helicoma sp.				1				1					1			0.33
Helicomyces macrofilametosus Matsush.				1			1									0.22
Helminthosporium velutinum Link									2							0.22
Hemicorynespora mitrata (Penz. & Sacc.) M.B. Ellis	3			1			4						1		3	1.33
Hyphomycete sp.1*			2	3			2	3							3	1.44
Hyphomycete sp. 2*						1										0.11
Hyphomycete sp. 3*											4					0.44

Table 1. *Cont.*

Taxa	Site 1			Site 2			Site 3			Site 4			Site 5			Percentage occurrence
	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	
Leptosphaerella sp.	1														1	0.22
Memnoniella subsimplex (Cooke) Deighton	14	11	17	7	6	14	10	7	21	1	1	5	2	1	15	14.67
Minimelanolocus sp.			1													0.11
Monodictys trichocladiopsis Goh & K.D. Hyde	1	3			1		1	2			3	1		3		1.67
Mycosphaerella sp.			14			5			16			6			3	4.89
Nigrospora oryzae (Berk. & Broome) Petch #			1			1			4	1		4				1.22
Ophiobolus sp.				5			1									0.67
Penicillium sp.				4	1							8	3		1	1.89
Periconia digitata (Cooke) Sacc.	16	6	1	23	10	8	44	27	20	23	10	13	41	31	19	32.44
Periconia lateralis Ellis & Everh.									1			1			4	0.67
Periconiella musae Stahel ex M.B. Ellis #	3	4	10	2	2	17	1	2	10			8	3		12	8.22
Phaeoisaria sp.*						1						4				0.56
Phoma sp.	2		2						1		9	9		10		2.56
Phomopsis sp.1										2			1			0.33
Phomopsis sp.2													1			0.11

Table 1. *Cont.*

Taxa	Site 1			Site 2			Site 3			Site 4			Site 5			Percentage occurrence
	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	
Pithomyces chartarum (Berk. & M.A. Curtis) M.B. Ellis							1									0.11
Pseudobotyrtis terrestris (Timonin) Subram.	1	14		6	12	12	13	18	1	3	15	5	5	14	3	13.56
Pseudocercospora sp.												2			1	0.33
Pyriculariopsis parasitica (Sacc. & Berl.) M.B. Ellis[#]	14	3		25	3		19	3		7	1	1	21	3		11.11
Scolecobasidium sp.		1	2	3			3		3							1.33
Sphaeromyces sp.							3									0.33
Sporidesmium aquaticum Cabella, Mengasc. & Aramb.								5								0.56
Sporoschisma saccardoi E.W. Mason & S. Hughes										4						0.44
Stachybotrys nephrospora Hansf.				1												0.11
Stachybotrys ruwenzoriensis Matsush.					6									9		1.67
Stachybotrys suthepensis Photita *et al.*	5	10		4	5		2	4	5				10	9		6.00
Stachybotrys theobromae Hansf.	2	1		1	2			3			5		2	6	1	2.56
Stachylidium bicolor Link	6	3	4	5	4		5	3	6	3			22	9	15	9.44
Stilbocrea gracilipes (Tul. & C. Tul.) Samuels & Seifert		1		2			1	1				1		1		0.78

Table 1. *Cont.*

Taxa	Site 1			Site 2			Site 3			Site 4			Site 5			Percentage occurrence
	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	P	Ps	L	
Tetraploa aristata Berk. & Broome	1															0.11
Torula herbarum (Pers.) Link[#]	8	19			12		1	3	1		2	6		20	1	8.11
Torula herbarum f. *quaternella* Sacc.	5	4									1	1				1.22
Trichoderma sp.						1	1									0.22
Verticillium tenuissimum Corda[#]	14	5	9	21	18	25	11	6	12	7	8	9	16	3	8	19.11
Zygosporium oscheoides Mont.	5	2	39	1					7	3		12		2	5	8.44
Total species (80)																
Total collection (1931)																

(a) site 1 = Ban Suthep (350 m above sea level)
site 2 = Montatarn waterfall (600 m above sea level)
site 3 = Medicinal Plant Garden (950 m above sea level)
site 4 = San Gu Region (1400 m above sea level)
site 5 = Queen Sirikit Botanic Garden (600 m above sea level)
*Probably a new species
[#] Endophytes also recorded in Photita *et al.* (2001b)

percentage occurrence of fungal species on the same host at different sites have been also commonly noted in mangroves. It is likely that this results from different environmental conditions (Alias *et al*., 1995; Hyde & Lee, 1995). Comparing fungi on the palm *Archontophoenix alexandrae* in Hong Kong, North Queensland and Malaysia, Taylor *et al.* (2000) found very few overlapping fungi. The differences in fungal communities were probably a result of removal of the host from its natural habitat as the host is not endemic to Hong Kong or Malaysia. Fungal tissue-specificity must also be important in estimating fungal diversity, as a ratio of six fungi to each host plant is easier to obtain if the fungi on different plant organs also differ.

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NOTES ON HYPHOMYCETES. XC. FUSICLADOSPORIUM, A NEW GENUS FOR CLADOSPORIUM-LIKE ANAMORPHS OF VENTURIA, AND THE PECAN SCAB-INDUCING FUNGUS

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ABSTRACT

A new genus, *Fusicladosporium*, is named to accommodate *Cladosporium caryigenum*, the causal organism of pecan scab, and the *Cladosporium* mitosporic states of *Venturia carpophila* [*C. carpophilum*] and *Venturia acerina* [*C. humile*]. Comments are made on the morphological disparities between these entities and *Cladosporium sensu stricto* species, as well as on differences in the respective physiology and resultant habits of the two groups, particularly with regard to plant pathogenicity. Some deliberation on the significance of teleomorph/anamorph connections is offered, including opinions on the current state of the taxonomy of some anamorphs associated with the genera *Mycosphaerella* and *Venturia*. The matter of generic concepts and circumscription within the *Cladosporium* complex is further revisited.

KEYWORDS: *Fusicladium*, *Karakulinia*, maple scab, peach scab, generic concepts.

INTRODUCTION

Among the most ubiquitous, commonly-encountered and best known of the wide variety of acropetally catenate Hyphomycete form-genera is *Cladosporium* Link, an anamorph genus whose taxonomy has, during the course of the past several decades, been in a state of considerable flux as a result of differing opinions as to its conceptualization and definition. Well over five hundred specific epithets have been established in *Cladosporium* since its inception in 1815 by Johann Heinrich Friedrich Link (Morgan-Jones and Jacobsen, 1988; Prasil and de Hoog, 1988). Species of this genus have been described from a broad range of substrates, in many disparate ecological niches, and include both saprotrophic and plant pathogenic forms. The latter, some of which appear to be host-specific, induce various symptoms, including necrotic leaf-spots. The plethora of extant taxa, at least in part, is an outcome of the habit of recognizing novel species purely or mostly on host relationships. There has also been a long history of naming new species without critical regard for the hallmark characteristics of the genus. Many such species have been removed elsewhere but there remain many that are either misplaced or are inappropriately classified because of the long-standing ill-defined nature of the genus. With the adoption of a broad circumscription it has been felt that this genus has become unduly cumbersome, heterogeneous, polyphyletic, and unsatisfactorily defined (von Arx, 1981; McKemy and Morgan-Jones, 1990). Moreover, because of the large number and diverse nature of species accommodated within the genus, a review and revision of both individual entities and of the generic concept has long been overdue. While a true monograph of the genus, involving critical consideration of the status and the typification or lectotypification of numerous species, would be a daunting and perhaps impossible task, due to the number of taxa involved and the doubtful availability and inadequate condition of many type specimens, certain aspects of the genus can be reconsidered with the aim of refining its taxonomy.

During the course of the past half century some attempt has been made at more satisfactorily characterizing some of the most frequently encountered taxa, particularly those isolated in axenic culture, and comprehensive, modern documentation of the distinguishing features of such have been published (de Vries, 1952; Morgan-Jones and McKemy, 1990; McKemy and Morgan-Jones, 1990, 1991a, 1991b, 1992; Ho *et al.*, 1999). Ellis (1971; 1976) provided brief descriptions and illustrations of forty-three species. In a contribution toward a better understanding of some entities included in *Cladosporium*, David (1997) considered anamorphs classified at one time or other in the genus *Heterosporium* Klotzsch ex Cooke. In contrast with the view held by von Arx (loc. cit.), Boerema and Hamers (1989), and McKemy and Morgan-Jones (1990) to the effect that *Heterosporium* should be recognized as a separate genus, David (loc. cit.) followed the decision made by de Vries (loc. cit.), and subsequently adhered to by Ellis (1971, 1976), of regarding it as being congeneric with *Cladosporium*, though classifying it as a subgenus.

In a *sensu lato* circumscription of *Cladosporium* the genus contains mitosporic fungi that, although to some extent related phylogenetically, constitute morphologically disparate elements which possess differing physiological capacities indicative of various degrees of genetic distance. As such, as alluded to above, it contains obligate, necrotic leaf spot-inducing plant pathogens as well as saprotrophic forms, of which the type species, *Cladosporium herbarum* (Pers.) Link, is an example. Anamorphs of both *Mycosphaerella* Johanson and *Venturia* Sacc., two genera of the Loculoascomycetes, are classified within *Cladosporium sensu lato*. The teleomorph of *C. herbarum* is *Mycosphaerella tassiana* (De Not.) Johanson [see von Arx (1950), Barr (1958)]. In a narrower, *sensu stricto*, generic concept, as advocated by von Arx (1983) and McKemy and Morgan-Jones (1990), the generic name *Heterosporium* is adopted for a morphologically distinct group of species which are the causal organisms of leaf lesions. The teleomorphs connected with these, some of which were originally classified in the genus *Didymellina* Höhn. [see Jacques (1941)], constitute a distinct group within *Mycosphaerella* which can be differentiated from other species by ascospore size. Likewise, the anamorphs of *Venturia* which resemble *Cladosporium* in having catenate conidia must be recognized as a discrete cluster of taxa. As noted by David (loc. cit.), following the statements made by von Arx (1983) and Morgan-Jones and Jacobsen (1988), the latter anamorphs are an anomaly within *Cladosporium* because, quite apart from their morphological and physiological peculiarities, the genus is rendered polyphyletic by their inclusion. Given the fact that they comprise a heterogeneous element, as David (loc. cit.) has suggested, they should be transferred out of the genus. These taxa have been classified at various times in *Fusicladium* Bonord., *Karakulinia* N.P. Golovina, or *Megacladosporium* Vienn.-Bourg., but none of these genera can be considered as fully satisfactory and available depositories for them. Neither the type species of *Fusicladium*, *F. pyrorum* (Lib.) Fuckel, the anamorph of *Venturia pirina* Aderh., nor that of *Karakulinia*, *K. cerasi* (Rabenh.) N.P. Golovina, the anamorph of *Venturia cerasi* Aderh., typically form conidia in chains. Since the latter entity fits comfortably within the morphological confines of *Fusicladium*, *Karakulinia* must be regarded as a synonym of it (Deighton, 1967). Hughes (1958) specified *Megacladosporium pyrorum* (Lib.) Vienn.-Bourg., being the first treated among the original taxa, as the lectotype species of the genus *Megacladosporium*. Since this binomial is based on the same anamorph as that typifying *Fusicladium*, *Megacladosporium* is also a synonym of that genus.

The anamorphs of *Venturia carpophila* E.E. Fisher and *V. acerina* Plakidas ex M.E. Barr are two necrotic leaf spot-inducing entities, occurring on peach and on maple, respectively. Although currently classified as *C. carpophilum* Thüm. and *C. humile* Davis, respectively, neither of these fits satisfactorily within a *sensu stricto* concept of *Cladosporium.* A similar species, both in morphology and in habit, is *Cladosporium caryigenum* (Ellis & Langl.) Gottwald, the causal organism of pecan scab, which has no known teleomorph. All three resemble *Cladosporium herbarum* in possessing branched chains of cicatrized conidia, as well as in forming scars at conidiation loci. However, the conidiophores of these species are rather different from those of *C. herbarum* and similar saprotrophic *Cladosporium* species, specifically in being typically shorter and more determinate in their growth, with a highly restricted conidiogenous region toward the extreme distal end. Conidiophores commonly occur in caespitose clusters of a few and often originate from stromata or rudimentary stromata. In addition, the conidia of these taxa are readily distinguishable by being more fusiform in shape, compared to those of *sensu stricto Cladosporium* species, which are typically ellipsoid to subglobose or oblong with obtuse ends. These morphological distinctions, along with the disparities in ecological habits, substrate relationships, and different teleomorph associations where known, clearly justify the segregation of these species in a separate genus. Although undoubtedly having closer phylogenetic affinity with *Fusicladium* rather than with *Cladosporium*, these anamorphs differ morphologically from the former genus also to a significant degree, most notably with regard to typically forming conidia in chains, and the degree of development and prominence of conidial scars on conidiophores. On the basis of the existing disconnect between this discrete cluster and *Fusicladium sensu stricto*, and to refine and improve the taxonomy, a new generic name is proposed below.

TAXONOMIC PART

Fusicladosporium Partridge et Morgan-Jones, gen. nov.

Coloniae hypophyllae vel epiphyllae, effusae, brunneae vel nigrae. Mycelium partim superficiale, sed in substrato immersum, ex hyphis ramosis, septatis, laevibus, brunneis compositum. Stromata immersa, pseudoparenchymatica, ex cellulis brunneis, isodiametricis composita, vel rudimentaria, vel nulla. Conidiophora macronemata vel semi-macronemata, mononemata vel, erecta, simplicia vel ramosa, recta vel leviter undulata, cylindrica, septata, laevia vel verrucosa, brunnea. Cellulae conidiogenae polyblasticae, in conidiophoris incorporatae, terminales, indeterminatae. Conidia acropleurogena, holoblastica, in catenis simplicibus vel ramosis acropetis formata, sicca, aseptata vel septata, laevia vel verrucosa, fusiforma vel cylindrica, pallide brunnea vel brunnea.

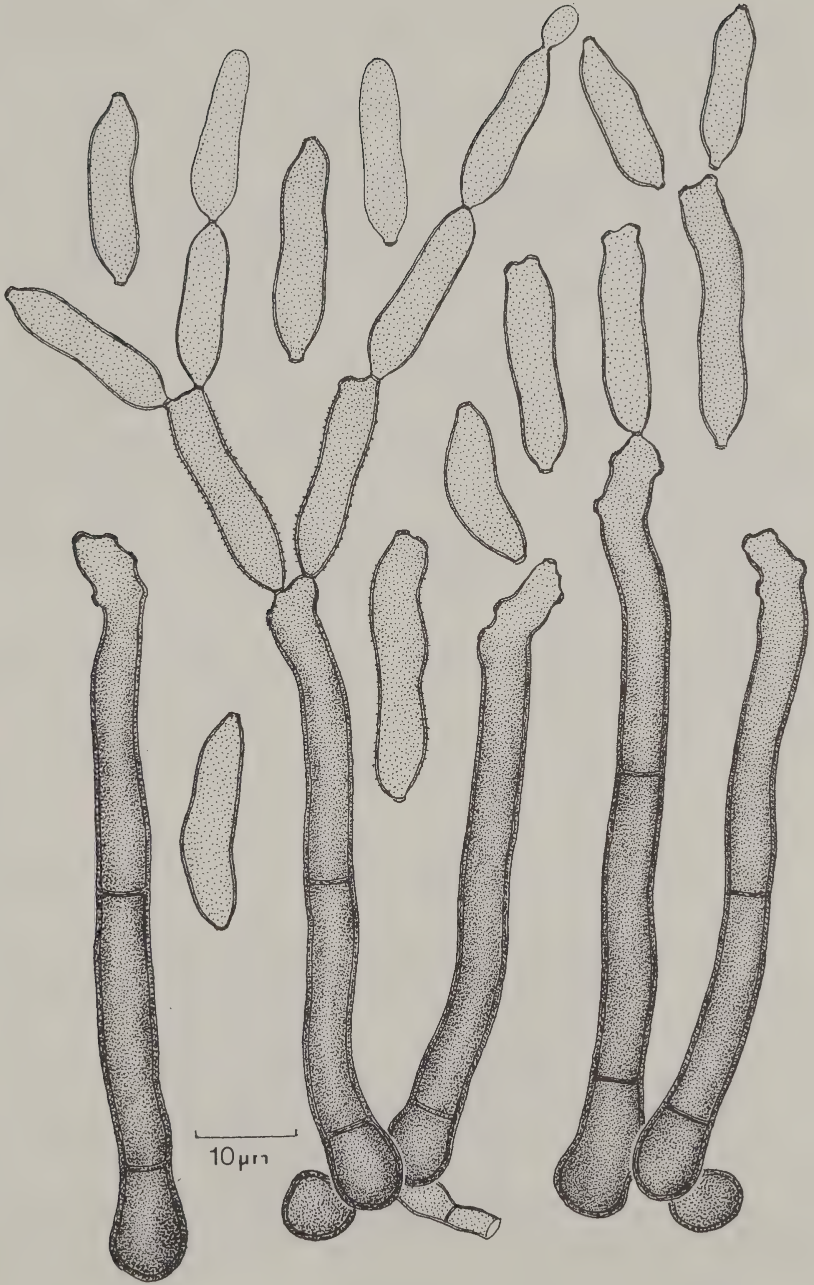

FIGURE 1. *Fusicladosporium carpophilum*. Conidiophores and conidia.

Species typica: *Fusicladosporium carpophilum* (Thüm.) Partridge et Morgan-Jones.

Fusicladosporium Partridge & Morgan-Jones, gen. nov.

Colonies hypophyllous or epiphyllous, effuse, brown to black. Mycelium partly superficial, partly immersed, composed of branched, septate, smooth, brown hyphae. Stromata, where present, mostly sub-epidermal, partly epidermal or erumpent, pseudoparenchymatous, composed of brown, thick-walled, more or less isodiametric cells, sometimes rudimentary in development, or absent. Conidophores macronematous or semi-macronematous, mononematous or in clusters arising from stromatic hyphae, erect, simple or occasionally branched, straight to somewhat undulate, cylindrical, septate, smooth or occasionally verruculose distally, brown to dark brown, sometimes inflated at the base. Conidiogenous cells polyblastic, integrated, mostly terminal, somewhat indeterminate. Conidia acropleurogenous, holoblastic, in simple or branched acropetal chains, dry, generally unicellular, occasionally 1- or 2-septate, smooth to verruculose, fusiform to cylindrical, pale brown to brown.

Fusicladosporium carpophilum (Thüm.) Partridge & Morgan-Jones, comb. nov. (Figure 1).

≡ *Cladosporium carpophilum* Thüm., *Osterr. bot. Zeitschr.* 27:12, 1877.

≡ *Fusicladium carpophilum* (Thüm.) Oudem., *Verh. K. Akad. Wet.* 1900:388, 1900.

≡ *Megacladosporium carpophilum* (Thüm.) Vienn.-Bourg., *Les champignons parasites des plantes cultivees* 1:489, 1949.

= *Fusicladium pruni* Ducomet, *Thèse Fac. Sci.* Paris: 137, 1907.

= *Fusicladium amygdali* Ducomet, *Annls Ec. natn. Agric. Rennes* 4:11, 1911.

Teleomorph: *Venturia carpophila* E.E. Fisher, *Trans. Br. mycol. Soc.* 44:339, 1961.

Colonies effuse, olivaceous brown to black. Mycelium partly immersed, partly superficial, composed of 3 to 4 µm wide hyphae. Stromata

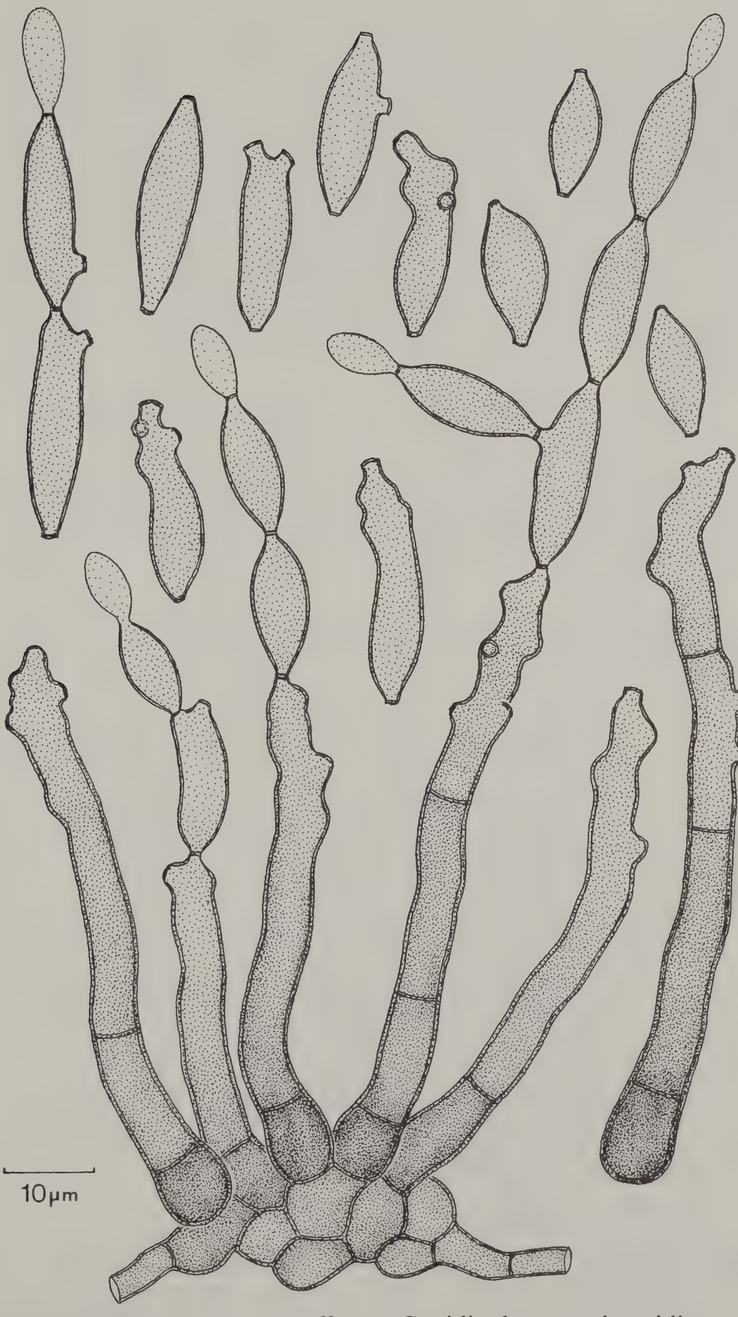

FIGURE 2. *Fusicladosporium effusum*. Conidiophores and conidia.

absent but with one or more swollen hyphal cells in proximity of conidiophore origin. Conidiophores macronematous or semi-macronematous, mononematous, ascending, more or less erect, straight or somewhat flexuous, mostly simple, smooth, septate, thick-walled, cylindrical, pale to mid brown, generally up to 90 µm long, 4 to 6 µm wide. Conidiogenous cells polyblastic, integrated, terminal, indeterminate. Conidia acropleurogenous, holoblastic, in simple or branched chains, dry, mostly unicellular, smooth or somewhat verruculose, thick-walled when mature, fusiform or cylindrical with an occasional slight constriction in the middle part, bearing one or more, where ramoconidial in form, protuberant, often wide, thick scars, 10-30 X 4-5 µm in size.

On peach, plum, apricot and almond trees; cosmopolitan.

Specimens examined: on leaves of *Prunus persica* (L.) Batsch, Auburn, Lee County, Alabama, USA, E.C. Partridge, 25 June 1999, AUA; on leaves of *P. persica*, Shorter, Macon County, Alabama, USA, E.C. Partridge, 6 July 1999, AUA.

Fusicladosporium effusum (G. Winter) Partridge & Morgan-Jones, comb. nov. (Figure 2).

≡ *Fusicladium effusum* G. Winter, *J. Mycol.* 1:101, 1885.

≡ *Fusicladium effusum* (G. Winter) Demaree var. *carpinum* Ellis & Everh., U.S. Dept. Agric., Agric. Handbook No. 165, p. 35, 1889.

= *Fusicladium caryigenum* Ellis & Langl., *J. Mycol.* 4:124, 1888.

≡ *Cladosporium caryigenum* (Ellis & Langl.) Gottwald, *Mycologia* 74:388, 1982.

= *Cladosporium effusum* Demaree, *J. Agric. Res.* 37:181, 1928.

Teleomorph: unknown.

Colonies hypophyllous, often coalescing, dark brown to black. Mycelium partly immersed, partly superficial, composed of branched, septate, olivaceous brown to brown, 1 to 3 µm wide hyphae. Stromata variously developed from rudimentary on leaves to relatively well-developed on shucks and twigs. Conidiophores semi-macronematous, ascending, more or less

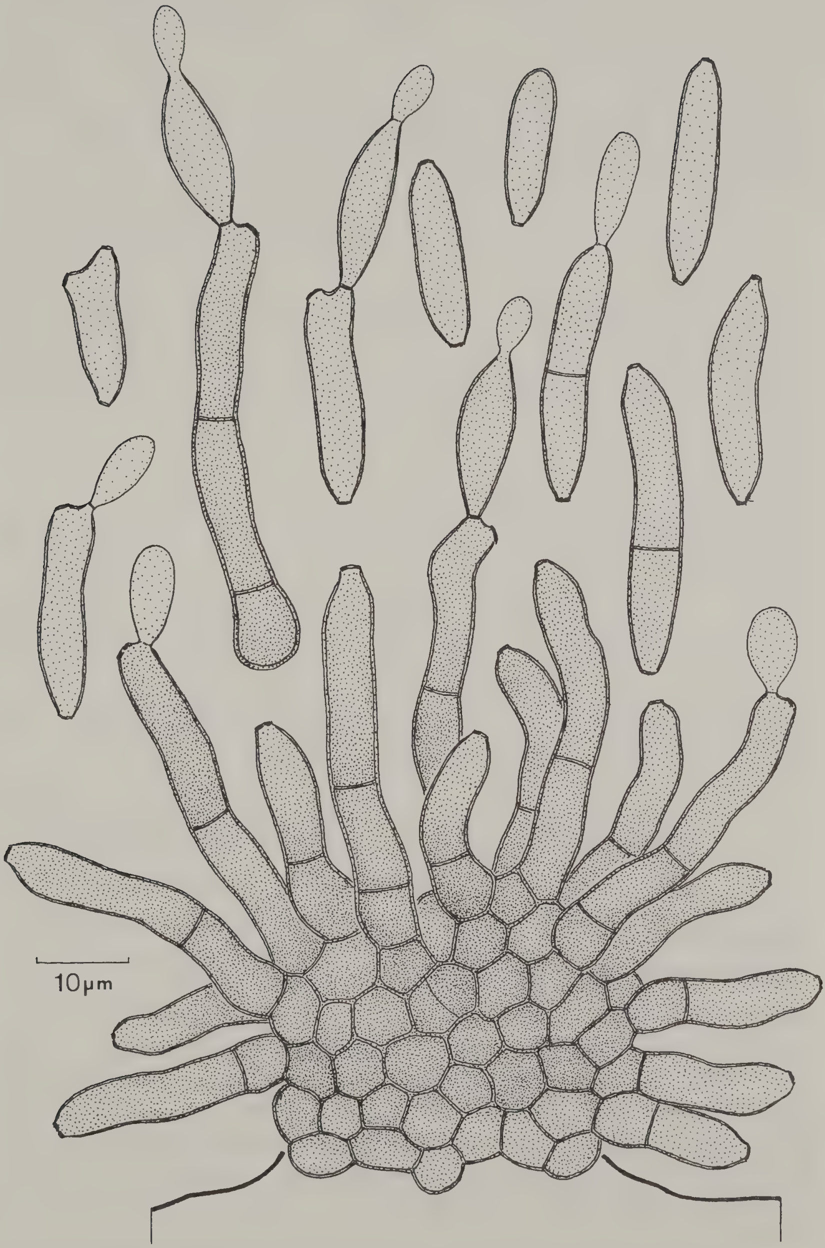

FIGURE 3. *Fusicladosporium humile*. Conidiophores and conidia.

erect, straight or somewhat flexuous, simple or occasionally branched, smooth, septate, rather thick-walled, cylindrical, dark brown, generally up to 150 μm long, 3 to 5 μm wide. Conidiogenous cells polyblastic, integrated, terminal, indeterminate. Conidia acropleurogenous, holoblastic, in simple or branched chains, dry, mostly unicellular or sometimes uniseptate, smooth, thick-walled, mostly fusiform, bearing one or more protuberant, wide scars, 10-40 X 5-10 μm in size.

On leaves, nuts, and stems of *Carya* species; North America.

Specimens examined: on leaves and shucks of *Carya illinoensis* (F.A. Wagenheim) K. Koch, Lee County Road 676, Auburn, Alabama, USA, E.C. Partridge, 1 June 1999, AUA; on leaves of *C. illinoensis*, Waverly, Lee County, Alabama, USA, E.C. Partridge, 23 May 2002, AUA.

Fusicladosporium humile (Davis) Partridge & Morgan-Jones, comb. nov. (Figure 3).

≡ *Cladosporium humile* Davis, *Trans. Wisc. Acad. Sci. Arts & Lett.* 19:702, 1919.

Teleomorph: *Venturia acerina* Plakidas ex M.E. Barr, *Can. J. Bot.* 46:814, 1968 [see also *Mycologia* 34:27-37, 1942].

Colonies amphigenous, effuse, olivaceous brown to black. Mycelium partly immersed, partly superficial, composed of branched, septate, light brown, 1 to 3 μm wide hyphae. Stromata usually well-developed. Conidiophores macronematous, mononematous where arising from superficial hyphae, or somewhat fasciculate, ascending, more or less erect, straight or somewhat flexuous, often geniculate, mostly simple, smooth, septate, rather thick-walled, cylindrical, mid brown, generally up to 70 μm long, 3 to 7 μm wide. Conidiogenous cells polyblastic, integrated, terminal, indeterminate. Conidia acropleurogenous, holoblastic, in simple or branched chains, dry, mostly unicellular, sometimes 1- or 2-septate, smooth, typically thick-walled, fusiform or cylindrical with an occasional slight constriction in the middle part, bearing one or more, where ramoconidial in form, protuberant, often wide, thick scars, 18-40 X 4-7 μm in size.

On leaves of *Acer rubrum* L. and *Acer saccharinum* L.; North America.

Specimen examined: on leaves of *A. rubrum*, Auburn, Lee County, Alabama, USA, E.C. Partridge, 5 August 1999, AUA.

DISCUSSION

As mentioned above, species of *Fusicladosporium* are morphologically quite distinct from those classified within a *sensu stricto* generic concept and circumscription of *Cladosporium*. Such taxa as *C. herbarum*, the type species of *Cladosporium*, as well as *C. cladosporioides* (Fresen.) G.A. de Vries, *C. oxysporum* Berk. & M.A. Curtis, *C. sphaerospermum* Penz., and *C. tenuissimum* Cooke, all exemplify the hallmark features upon which a narrow conception of this otherwise obviously heterogeneous genus is based. These species are characterized by a combination of morphological characters that serve to readily distinguish them from taxa classified in other similar anamorph form-genera. Their conidiophores are typically long and indeterminate, proliferating sympodially from zones of scattered, multiple conidogenous loci, which are often separated by non-fertile lengths. In some taxa conidiogenous loci occur on swollen nodes. Conidia are typically oblong with obtuse ends, and occur in distinct, easily-recognizable, branched chains. These species are primarily and predominantly saprotrophic in habit. Conidiophores of the species removed herein to *Fusicladosporium* are of a much different form, being more reminiscent of those of *Fusicladium*. They are typically shorter and more determinate, and proliferate in a somewhat undulating, sympodial nature. Conidiogenous loci are more proximal and localized, typically in one short, defined area toward the apex of the conidiophore. Conidia of *Fusicladosporium* species are generally fusiform, and form branched chains of a rather different aspect. These species are host-specific plant pathogens.

An important consideration in naming this novel genus is the matter of the teleomorph connections of the anamorphs under study. Barr (1958) and Corlett (1988) determined from single ascospore cultures that the anamorph of *Mycosphaerella tassiana* is probably *Cladosporium herbarum*, or at least a closely related *Cladosporium* species. Indeed, many entities classified in *Cladosporium* have *Mycosphaerella* teleomorphs. *Mycosphaerella* is a very large ascomycete genus, containing over six hundred described species, which have been connected to at least twenty different anamorph form-genera. The implications of this fact are enormous, especially when viewed in the context of a genus-for-genus philosophy. Whether *Mycosphaerella* itself should be split into several additional genera, and whether many of the anamorph genera connected to it should be consolidated, are possibilities. In any case, when the genus-for-genus concept is taken into account, it seems clear that species of *Cladosporium* should not be connected to more than one teleomorph genus. The establishment of the new genus *Fusicladosporium* is justified in part by the fact that the two species with known teleomorphs included within it are mitosporic states of *Venturia*. In essence, its conceptualization to a large extent parallels that of Viennot-Bourgin (1949) when he proposed the generic name *Megacladosporium*. Since the latter, however, has *M. pyrorum* as its lectotype species it is inappropriate and thereby becomes unavailable for anamorphs which bear conidia in chains.

The present authors remain skeptical concerning the usefulness and utility of a subgeneric classification, such as that advocated and adopted by David (loc. cit.) in the case of *Cladosporium/Heterosporium*, especially where a constant and clear multidimensional discontinuity exists between clusters of taxa. There is little precedence for this in Hyphomycete taxonomy, for a reason. Where there is enough indication of a significant genetic disconnect, the recognition of separate generic status makes eminent good sense and has been a long-standing practice. If consistency and stability are to be achieved and maintained, reality, rather than what David (loc. cit.) referred to as 'basic genetic potential', should surely be the overriding criterion for making taxonomic decisions. Hence the decision to establish *Fusicladosporium*, and the position taken that a strong argument in favor of the maintenance of *Heterosporium* as a separate genus can still be made. In terms of both phylogenetic precision as well as practicality, the traditional concepts by which form-genera are recognized appear to be still cogent, relevant, tenable, and, certainly, defensible. It should be added that infra-generic/supra-specific categorization has rarely stood the test of time and scrutiny in the classification of anamorphs and there are many examples of generic clusters, such as the *Cercospora*-complex, where subgeneric compartmentalization could well have been adopted but has never been seriously considered as an useful means of refining the taxonomy and reflecting various degrees of relatedness.

In the context of developing a suitable classification for the various known anamorphs of *Venturia*, the option of bestowing subgeneric status to such a taxon as *Fusicladosporium* within *Fusicladium* could perhaps be considered. We remain unconvinced, however, that an useful purpose would be achieved by such an action, given preponderant precedence, beyond indicating an arbitrary level of relatedness. If such a course were to be undertaken, the question of the appropriate taxonomic fate of other form-genera based on anamorphs known to be mitosporic states of *Venturia* would then arise. In accordance with a genus-for-genus philosophy, should the form-genera *Fusicladium*, *Pollaccia* E. Bald. & Cif., and *Spilocaea* Fr. be regarded as being congeneric, despite the obvious morphological and conidium ontogeny discontinuities existing between them? In which case, *Fusicladium* itself would, presumably, be relegated to subgeneric status, *Spilocaea* being the oldest generic name applied to a *Venturia* anamorph. By the same logic, how would one deal with the multitudinous anamorphic forms, including not only *Cladosporium* and *Heterosporium*, but such entities as *Cercospora* Fresen., *Ramularia* Unger, and *Septoria* Sacc. [see von Arx (1983)], produced within the *Mycosphaerella*-complex? The point must again be made that a practical, usable taxonomy for anamorphs, reflective of morphological disparities and phylogenetic divergence, cannot necessarily be achieved by broadly and arbitrarily conceptualizing form-genera in an attempt to parallel the classification of teleomorphs, especially when the latter is itself in need of refinement. Any attempt to integrate two differently-based classifications which are, by their very nature, fundamentally dissimilar and potentially incompatible, must surely be approached both judiciously and cautiously.

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NOTES ON HYPHOMYCETES. XCI. PSEUDOACRODICTYS, A NOVEL GENUS FOR SEVEN TAXA FORMERLY PLACED IN ACRODICTYS

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ABSTRACT

A new generic name is established in which to classify seven species previously accommodated in the broadly conceptualized genus *Acrodictys*, namely *A. appendiculata, A. brevicornuta*, *A. corniculata, A. deightonii, A. dennisii*, *A. eickeri*, and *A. viridescens*. This relatively homogeneous cluster of anamorph entities is characterized by production of large, somewhat irregularly shaped, more or less evenly dark-colored, numerous-celled conidia whose septa are orientated obliquely giving a textura angularis type appearence. Six of the taxa are redescribed and illustrated from type specimens and a reformated treatment of *A. corniculata*, based on the original characterization, is included. Additional comments are offered on the diversity of forms found within *Acrodictys sensu lato*.

KEYWORDS: *Junewangia*, *Rhexoacrodictys*, generic concepts

INTRODUCTION

During the course of conducting revisionary studies in the genus *Acrodictys* M.B. Ellis *sensu lato* it has become increasingly apparent that the unduly-broad, widely-encompassing generic concept adopted for this entity at and subsequent to its establishment has led to its containing an unacceptably heterogeneous assemblage of anamorphs. As alluded to previously (Baker *et al.*, 2002a, 2002b), a number of what appear to be morphologically discrete clusters of species exist within *Acrodictys* as historically constituted, making taxonomic revision desirable. As more and more taxa have been added to the genus over the years the apparent discontinuities between these various mitosporic fungi have become more obvious and thereby the necessity of substantive reevaluation has become more urgent. A number of previous authors have also commented on the rather broad generic circumscription of the genus, for example Sutton (1969), Hughes (1979), and Sutton and Alcorn (1984). In this context it should be clearly stated that the present authors take the view that exceedingly-inclusive generic concepts do not necessarily serve an useful purpose, particularly if they are not correctly reflective of relatedness. To meet this need, some progress in this direction has been made with the establishment of the segregate genera *Junewangia* W.A. Baker & Morgan-Jones and *Rhexoacrodictys* W.A. Baker & Morgan-Jones (Baker *et al.*, 2002a, 2002b). In addition, a monotypic new genus, *Acrodictyella* W.A. Baker and Partridge (Baker *et al.*, 2001), was named for an unique taxon which might well, prior to the reconceptualization and consequent recircumscription of *Acrodictys*, have been placed in it. There remain, however, a large number of taxa whose classification cannot, at present, be regarded as being satisfactory and which must, therefore, eventually be transferred elsewhere. Some mention is made of several peculiarly and singularly unique entities in the discussion below.

Among the clusters of species and anomalous taxa not considered in detail hithertofore, is a comparatively homogeneous group characterized by possession of conidia which are relatively large, in some cases somewhat irregularily shaped, numerous-celled, heavily and evenly pigmented, with septa oriented obliquely giving a textura angularis aspect. As conidia of these taxa mature many of their cells become compressed, appreciably contorted, and, in some instances, appear to collapse, resulting in a deformed, dilapidated internal appearance. Moreover, in several species, a tendency for conidia to readily shrivel is apparent. These phenomena may, in part at least, be due to the large conidial surface area and a consequent desiccation factor. An additional distinctive feature is the presence of variously placed conidial appendages in most of the taxa. Conidiophores within this cluster are thick-walled, brown to very dark brown and varying in length, in part dependent upon whether or not any secondary growth occurs in relation to conidiation or somatic regeneration. In general, conidiophore proliferation is infrequent among these species and, in some, nonexistent.

Seven species exemplify the characteristics noted above and are considered to be sufficiently different from the type and other members of *Acrodictys sensu stricto* [see Baker et al., 2002a] to warrant separate recognition. Included are the anamorphs presently classified as *Acrodictys appendiculata* M.B. Ellis, *A. brevicornuta* M.B. Ellis, *A. corniculata* R.F.

Castañeda, *A. deightonii* M.B. Ellis, A. *dennisii* M.B. Ellis, *A. eickeri* Morgan-Jones, and *A. viridescens* B. Sutton & Alcorn. Accordingly, a novel genus is established for them herein and the taxa are redescribed and illustrated from type specimens, with the exception of *A. corniculata*. A reformatted treatment and somewhat modified illustration of the latter, based upon its original characterization (Castañeda, 1985), is provided.

TAXONOMIC PART

Pseudoacrodictys W.A. Baker et Morgan-Jones gen. nov.

Coloniae effusae, brunneae ad atrae. Mycelium partim superficiale, partim immersum, ex hyphis ramosis, septatis, pallide brunneis, levibus, crassis compositum. Conidiophora macronemata, mononemata, singula vel 2-3 fasciculata, ex terminalibus vel lateribus hypharum oriunda, erecta vel ascendentia, recta vel flexuosa, non-ramosa, laevia, crassi-tunicata, cylindrica, continua vel septata, brunnea ad atrobrunnea, determinata vel indeterminata et proliferationibus terminalibus successivis. Cellulae conidiogenae in conidiophoris incorporatae, terminales, monoblasticae, pallide brunnae vel brunnae, cylindricae, ad apicem truncatae. Conidia holoblastica, acrogena, solitaria, sicca, subsphaeroidea ad late pyriformia ad turbinata, vel irregulata, muriformia, septis numerosis obliquus predita, cum cellulae internae compactae ad compressae, brunnea ad atrobrunnea, aequaliter pigmentifera, laevia, parietibus crassis, et cellula basali truncata, secessio schizolytica; plerumque appendiculata.

Species typica: *Pseudoacrodictys eickeri* (Morgan-Jones) W.A. Baker & Morgan-Jones.

Pseudoacrodictys W.A. Baker et Morgan-Jones gen. nov.

Colonies effuse, brown to black. Mycelium superficial, partly immersed in the substrate, composed of branched, septate, pale brown to brown, smooth, hyphae. Conidiophores macronematous, mononematous, single or in loose fascicles of two or three, arising terminally or laterally from the hyphae, erect or ascending, straight or slightly flexuous, simple, smooth, thick-walled, cylindrical, aseptate or septate, brown to dark blackish-brown, determinate and non-proliferating or, more commonly, indeterminate and proliferating percurrently by one or a few successive terminal proliferations. Conidiogenous cells integrated, terminal, monoblastic, pale brown to brown, cylindrical, truncate at the apex following conidium disarticulation. Conidia holoblastic, acrogenous, solitary, dry, subglobose to broadly pyriform to turbinate or somewhat irregularly shaped, dictyosporous, bearing numerous septa arranged in an oblique fashion, with internal cells often becoming compressed and contorted at maturity, brown to dark brown, evenly pigmented, smooth, thick-walled, seceding schizolytically, with or, more rarely, without a distinctly protuberant, cuneate basal cell delimited by a transverse septum; commonly possessing pale brown, aseptate or septate, somewhat hyphae-like, more or less straight, undulate, or uncinate appendages which occasionally break or, when remaining intact, collapse at the thin-walled tip to give a truncate aspect.

Etymology: *Pseudo* Gr., false, et *Acrodictys.*

Pseudoacrodictys appendiculata (M.B. Ellis) W.A. Baker & Morgan-Jones comb. nov. (Figure 1).

≡ *Acrodictys appendiculata* M.B. Ellis, *Mycol. Pap.* 103:33, 1965.

Colonies effuse, hairy, brown to black. Mycelium superficial, partly immersed in the substrate, composed of branched, septate, pale brown to brown, smooth, 3-5μm wide hyphae. Conidiophores macronematous, mononematous, single, or less often, in groups of two or three, arising laterally from the hyphae, erect or ascending, straight or slightly flexuous, simple, smooth, thick-walled, cylindrical, aseptate, brown to dark brown, determinate, up to 35μm long, 3.5-4μm wide, 4-7.5μm wide at the base. Conidiogenous cells integrated, terminal, monoblastic, brown to dark brown, cylindrical, truncate at the apex following conidium disarticulation. Conidia holoblastic, acrogenous, solitary, dry, broadly pyriform to turbinate, dictyosporous, with numerous septa arranged in an oblique fashion, with internal cells often becoming stretched, elongated, compressed and, eventually, contorted at maturity, brown to dark brown, evenly pigmented, smooth, thick-walled, 27-45 × 22-30*μm,* seceding schizolytically, with a distinctly protuberant, cuneate, broadly truncate, 3.5-4μm wide basal cell delimited by a transverse septum; bearing 2-4 pale brown, aseptate or septate, more or less straight or gently curved, slightly attenuating, up to 56*μm* long appendages which are variously placed toward the upper reaches and occasionally break or, when remaining intact, collapse at the thin-walled tip to give a truncate aspect.

On dead culms of *Oxytenanthera abyssinica* Munro; Africa.

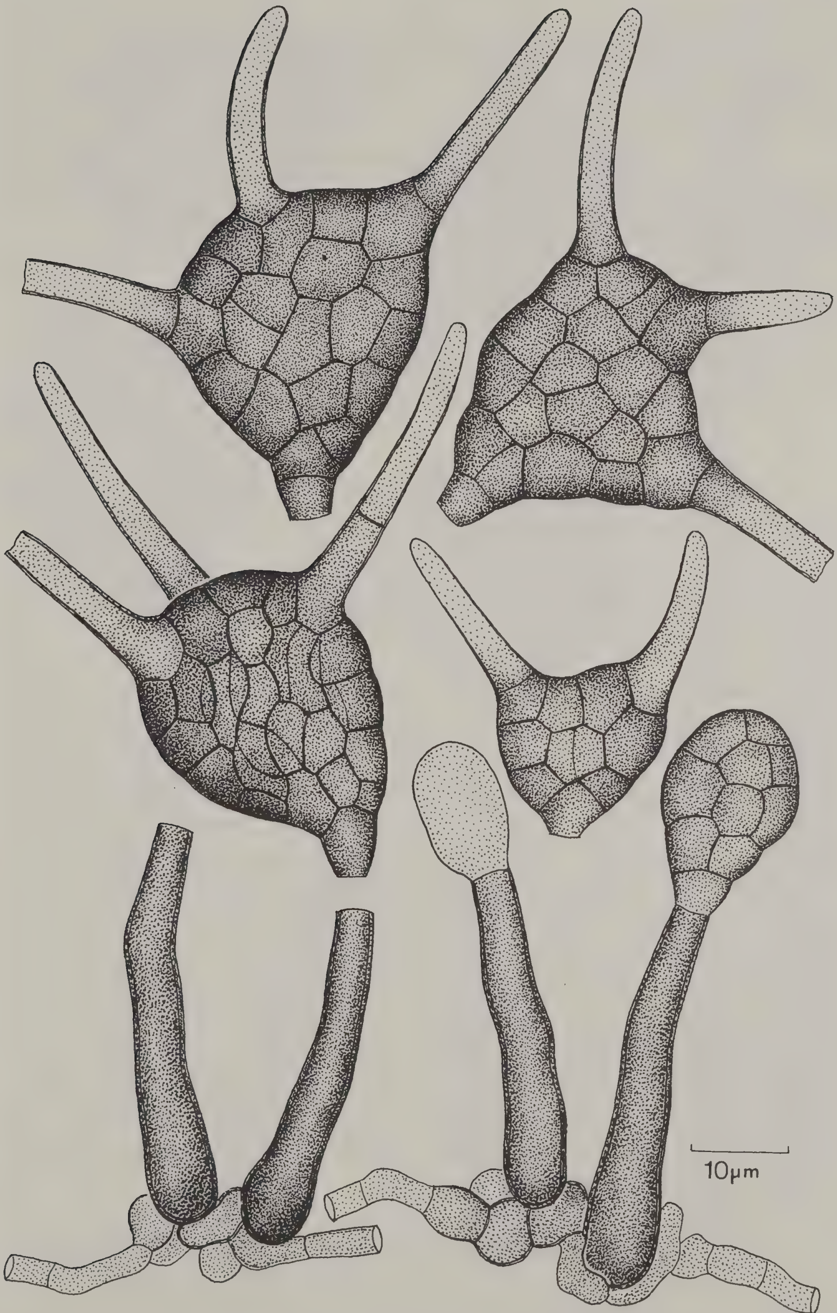

FIGURE 1. *Pseudoacrodictys appendiculata*. Conidiophores and conidia.

Collection examined: on *O. abyssinica*, road from Musaia to Okentu, 1 mile north of River Mongo, Sierra Leone, 8 October 1963, P.W. Sellars, IMI 74761b, holotype.

To our knowledge, this taxon is known only from its original collection. It is morphologically somewhat similar to *Acrodictys eickeri*, which is made the type species of *Pseudoacrodictys* herein. The two entities differ, however, in several respects. The conidia of *P. appendiculata* are appreciably smaller and appendage placement is more localized than is the case in *A. eickeri*. Moreover, the aseptate, non-proliferating nature of the conidiophores of *P. appendiculata* is an added distinction between the two, as is substrate relationship, *A. eickeri* occurring on dead, decorticated twigs.

Pseudoacrodictys brevicornuta (M.B. Ellis) W.A. Baker & Morgan-Jones comb. nov. (Figure 2).

≡ *Acrodictys brevicornuta* M.B. Ellis, *Mycol. Pap.* 79:16, 1961.

Colonies effuse, hairy, dark brown to black. Mycelium superficial, partly immersed in the substrate, composed of branched, septate, pale brown to brown, smooth, 2-4.5μm wide hyphae. Conidiophores macronematous, mononematous, single, arising laterally from the hyphae, erect or ascending, straight or slightly flexuous, simple, smooth, thick-walled, cylindrical, sometimes nodose with one or more swellings, septate, dark brown to dark-blackish brown, indeterminate, often elongating by percurrent proliferation, up to 300μm long, 5-7μm wide, 9-11μm wide at the base. Conidiogenous cells integrated, terminal, monoblastic, brown, cylindrical, truncate at the apex following conidium disarticulation. Conidia holoblastic, acrogenous, solitary, dry, irregularly subglobose with a slightly undulate outline, and frequently somewhat flattened dorsiventrally, dictyosporous, with numerous oblique septa, brown to dark brown, evenly pigmented, smooth, thick-walled, seceding schizolytically, 46-59 × 30-57μm in size, lacking a protuberant basal cell, usually bearing a number of pale-coloured, variously-placed, relatively-broad, thin-walled, papilla-like extensions.

On dead culms of *Bambusa* sp.; South America.

Collection examined: on bamboo, cloud forest, El Avila, Venezula, July 1958, R.W.G. Dennis [Flora of Venezuela 1311b], IMI 74761b, holotype.

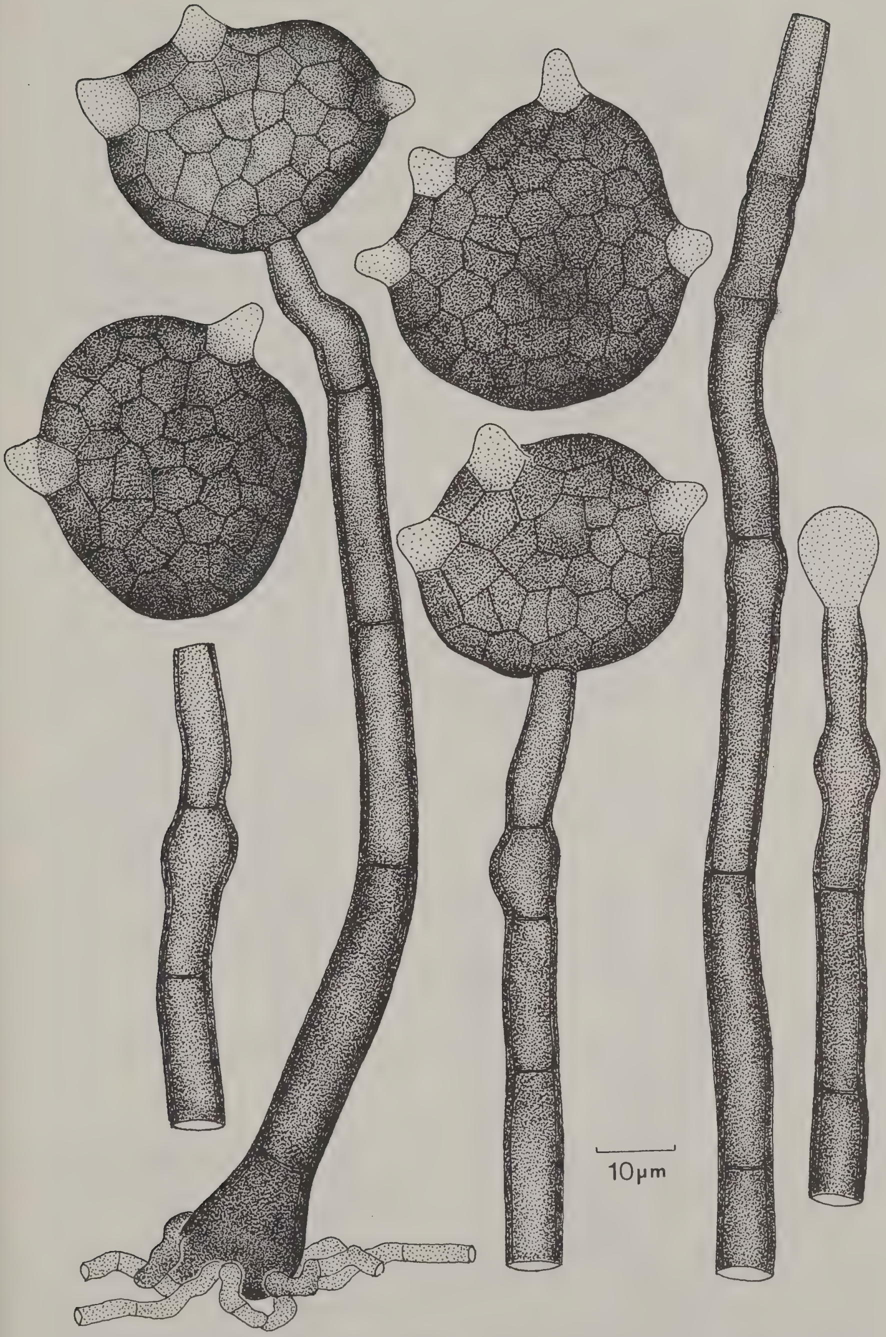

FIGURE 2. *Pseudoacrodictys brevicornuta*. Conidiophores and conidia.

This taxon, which is also known only from its type collection, is being placed in *Pseudoacrodictys* advisedly because it differs in some respects from the conceptualization of the genus as exemplified by the other species included. The absence of a distinctly protruding, broadly cuneate, basal cell renders it untypical, although the oblique orientation of the internal septa is similar to that occurring in the other taxa. Whether or not the former feature should be regarded as being phylogenetically informative remains, however, an open question. This entity is certainly misplaced in *Acrodictys sensu stricto* and has more in common with the cluster of species presently considered and removed to *Pseudoacrodictys*. Although additional future knowledge and deliberation may lead to the conclusion that the establishment of a further segregate genus in which to classify *P. brevicornuta* is warranted, for the present it seems best accommodated within the circumscription of the novel genus named herein despite the fact that it is somewhat anomalous and can be regarded, together with *A. deightonii*, as the least conforming among the taxa included. The conidial shape of *P. brevicornuta* also differs from that considered typical in being irregularly subglobose to somewhat dorsiventrally flattened, rather than broadly pyriform to turbinate as is generally characteristic of this group of taxa. Additionally, it should be noted that protrusion of some of the peripheral conidial cells in the form of broad papilla is an unique feature but these entities can be regarded as very short appendages.

Pseudoacrodictys corniculata (R.F. Casteñeda) W.A. Baker & Morgan-Jones comb. nov. (Figure 3)*.

≡ *Acrodictys corniculata* R.F. Castañeda,
Deuteromycotina de Cuba.Hyphomycetes II:1. *Inst. Invest. Fund. Agric. "Alejandro de Humboldt"*,
Havana, Cuba, 1985.

*[Description partly reformatted from information contained in Castañeda (1985) and amended.]

Colonies effuse, hairy, dark brown. Mycelium superficial, partly immersed in the substrate, composed of branched, septate, pale brown to olivaceous brown, smooth, 2μm wide hyphae. Conidiophores macronematous, mononematous, single, arising laterally from the hyphae, erect or ascending, straight or slightly flexuous, simple, smooth, thick-walled, cylindrical, aseptate or septate, brown to dark brown, indeterminate, usually elongating once or twice by successive, regenerative percurrent proliferation, up to 55μm long, 2.5-3.5μm wide, 5.5-7μm at the swollen base.

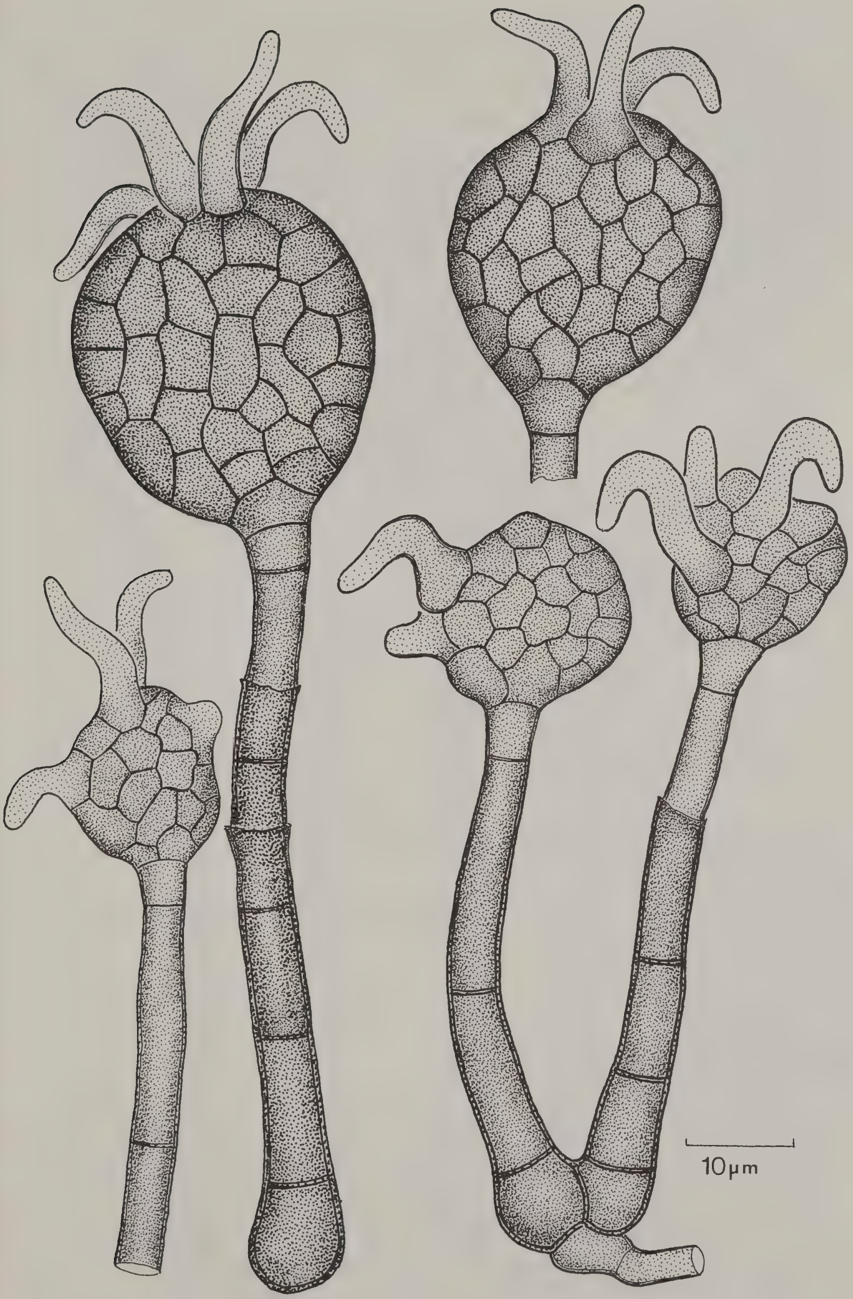

FIGURE 3. *Pseudoacrodictys corniculata*. Conidiophores and conidia [redrawn and modified from Castañeda (loc. cit)].

Conidiogenous cells integrated, terminal, monoblastic, pale brown to brown, cylindrical, truncate at the apex following conidium disarticulation. Conidia holoblastic, acrogenous, solitary, dry, subglobose to globose to broadly pyrifom, dictyosporous, with numerous septa arranged in an oblique fashion, brown, evenly pigmented, smooth, thick-walled, 19-35 × 17.5-30μm, seceding schizolytically, with a distinctly protuberant, cuneate, broadly truncate, 2.5-3.5μm wide basal cell delimited by a transverse septum; bearing 1-6 pale brown, aseptate, curved, horn-like, 8-20μm long, appendages clustered distally.

On fallen leaves of unidentified grass, Camagüey, Cuba , 28 November 1984, R.F.Castañeda, INIFAT, holotype. [Specimen not examined.]

In all essential characteristics, this species conforms well with the *Pseudoacrodictys* generic concept. Both its conidium morphology and the regenerative percurrent growth of its conidiophores are typical of the genus and closely resemble those of the type species, *P. eickeri*. Moreover, the internal cellular organization and the tendency for compression appear to be similar to the condition seen in other taxa within this cluster. *Pseudoacrodictys corniculata* can be readily distinguished by the smaller dimensions of its conidia and the peculiarities of its conidial appendages in terms of both placement and morphology. It should be duly noted that in this taxon recurrent conidiophore growth occurs following an irregular tearing of the periclinal wall not directly associated with sequential conidiation. This phenomenon occurs variously among *Pseudoacrodictys* species and is considered at further length in the discussion below.

Pseudoacrodictys deightonii (M.B. Ellis) W.A. Baker & Morgan-Jones comb. nov. (Figure 4).

≡ *Acrodictys deightonii* M.B. Ellis, *Mycol. pap.* 79:17, 1961.

Colonies effuse, hairy, dark brown to black. Mycelium superficial, partly immersed in the substrate, composed of branched, septate, pale brown to dark brown, smooth, 2-5μm wide hyphae. Conidiophores macronematous, mononematous, single, arising laterally from the hyphae, erect or ascending, straight or slightly flexuous, simple, smooth, thick-walled, cylindrical, septate, dark brown, indeterminate, often elongating by one or more successive, cylindrical to broadly barrel-shaped, percurrent proliferations, up to 200μm long, 3.5-5μm wide, 7.5-10μm wide at the slightly swollen base. Conidiogenous cells integrated, terminal, monoblastic, dark brown,

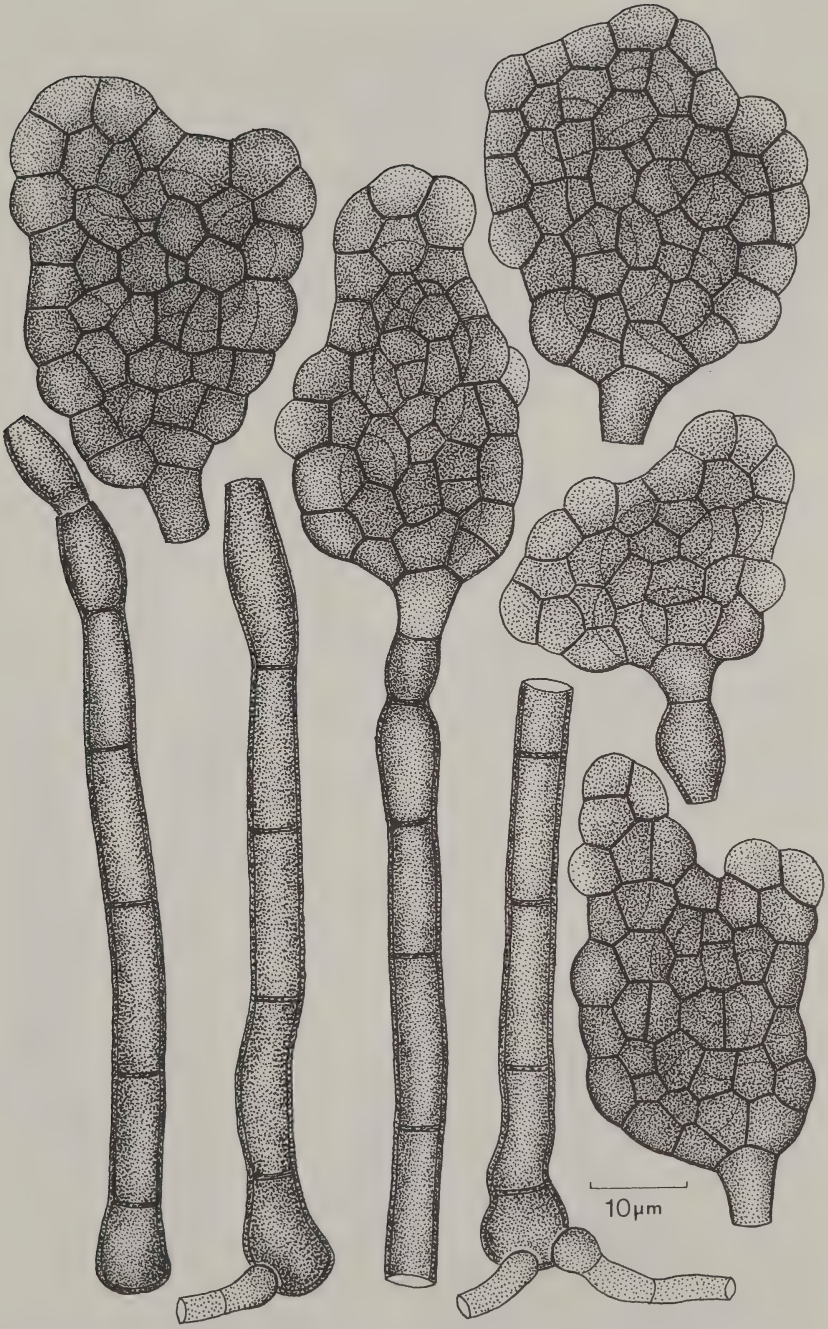

FIGURE 4. *Pseudoacrodictys deightonii*. Conidiophores and conidia.

cylindrical or, more often, slightly swollen, truncate at the apex following conidium disarticulation. Conidia holoblastic, acrogenous, solitary, dry, highly variable in shape, ranging from irregularly turbinate to obpyriform with an uneven outline to somewhat napiform, often having a slightly botryose aspect derived from swollen and protruding peripheral cells, dictyosporous, with numerous oblique septa, brown to dark brown, evenly pigmented, smooth, thick-walled, seceding schizolytically, 42-84 × 28-57μm, with a distinctly protuberant, cylindrical to somewhat cuneate, broadly truncate, 3.5-5μm basal cell delimited by a transfer septum.

On dead branches of *Cassia fruticosa* Mill., *Gardenia nitida* Hook., and *Rauwolfia vomitoria* Afzel.; Africa.

Collections examined: on *C. fruticosa*, Njala (Kori), Sierra Leone, 3 November 1949, F.C. Deighton, IMI 40266, holotype; on *G. nitida*, same location, 12 September 1949, same collector, IMI 38344; on *R. vomitoria*, same location, 18 August 1949, same collector, IMI 38203a.

As is the case with *P. brevicornuta*, this taxon is being reclassified in *Pseudoacrodictys* with some reservation due to the fact that it does not fully conform with what can be considered the central, hallmark characteristics by which the genus is conceptualized. However, short of placing it in a monotypic genus of its own, which has been seriously considered during the course of this study, no alternative taxonomic home is currently available. By its accommodation in *Pseudoacrodictys*, for the present, a conservative position is being adopted. Although exemplifying a 'textura angularis' cellular organization, the internal structure in *P. deightonii* appears to differ from the condition seen in most of the other species in that the individual cells retain their shape and do not become distorted by compression as the conidia mature. In all the material examined no evidence of internal crushing and disintegration could be discerned. The presence of swollen, in some cases thinner-walled, protruding marginal cells is another unique peculiarity of this species. Such entities cannot, however, be regarded as appendages and are not comparable with the papillae of *P. brevicornuta*. The presence of somewhat barrel-shaped, percurrent conidiophore proliferations, which can sometimes remain attached following conidial secession, is another point of distinction between *P. deightonii* and what can be considered typical of the genus. In this regard, it bears some similarity to species of *Acrodictys sensu stricto* [see Baker *et al.* (2002b)]. Percurrent conidiophore proliferation in the latter, however, which appears to be similar in kind to that occurring in such genera as *Imicles* Shoemaker & Hambleton [see Hernández-Gutiérrez and Sutton (1997)], *Brachysporiella* Bat., and *Penzigomyces* Subram., is rather different

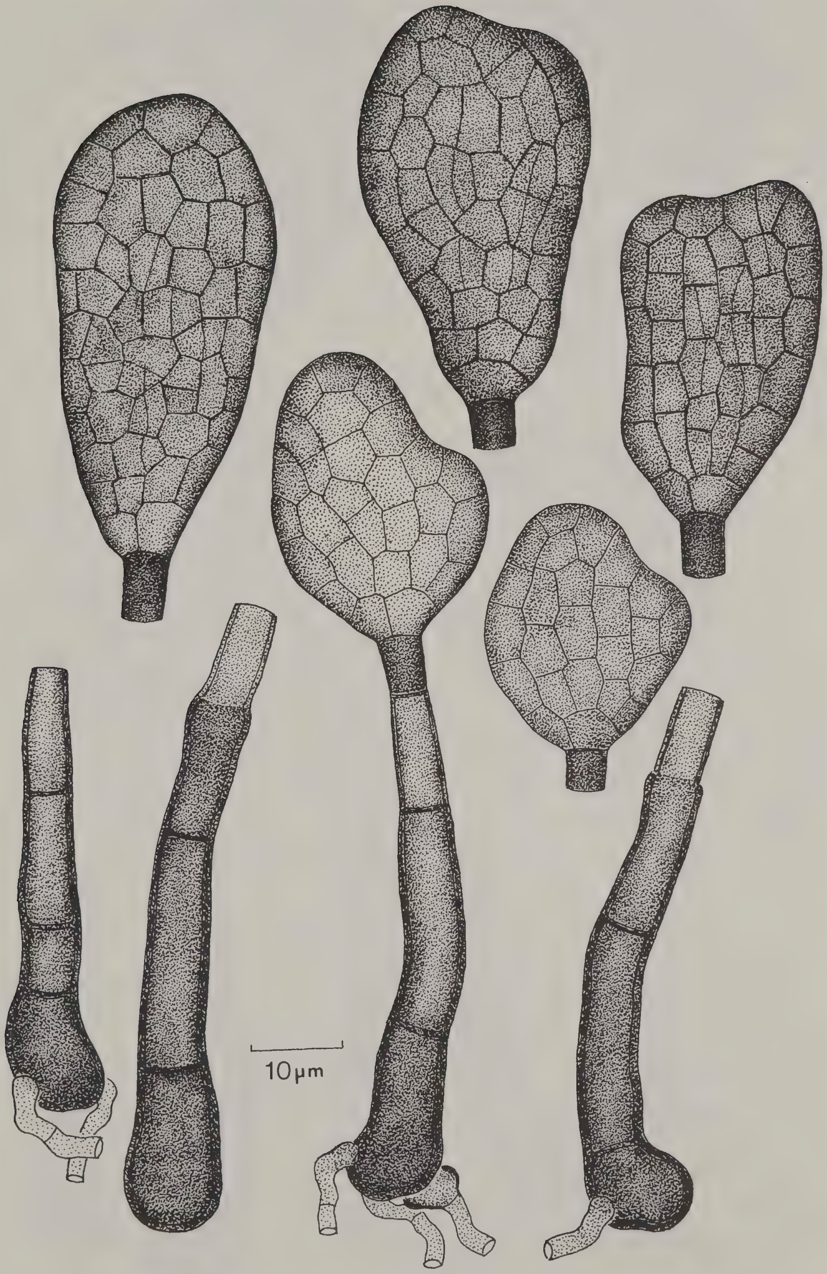

FIGURE 5. *Pseudoacrodictys dennisii*. Conidiophores and conidia.

from that seen in *P. deightonii.* In this species a broad half septum is involved in the secondary growth, whereas in the aforementioned genera proliferation originates from a narrow locus at the septal pore [see Minter and Holubová-Jechová (1981)].

Pirozynski (1972) reported a collection of *Pseudoacrodictys deightonii* [as *Acrodictys deightonii*] overgrowing *Exosporium monanthotaxis* Piroz., which occurs on dead, attached twigs of *Monanthotaxis poggei* Engl. & Diels in Tanzania, and referred to it as being hyperparasitic. Early stages of development were illustrated in which the upper reaches of young conidia were shown to have a distinctly lobed configuration which becomes progressively obscured as the conidia enlarge. The barrel-shaped percurrent proliferations of the conidiogenous cells were described as being of a 'regeneration' type in which a new inner wall breaks through a delimiting half-septum by tearing it irregularly.

Pseudoacrodictys dennisii (M.B. Ellis) W.A. Baker & Morgan-Jones comb. nov. (Figure 5).

≡ *Acrodictys dennisii* M.B. Ellis, *Mycol. Pap.* 79:15, 1961.

Colonies effuse, dark brown to black. Mycelium superficial, partly immersed in the substrate, composed of branched, septate, pale brown to olivaceous brown, smooth, 2-3μm wide hyphae. Conidiophores macronematous, mononematous, single or in clusters of two or, less often, three, arising laterally from the hyphae, erect or ascending, straight or slightly flexuous, simple, smooth, thick-walled, cylindrical, septate, dark brown to blackish-brown, paler distally, indeterminate, usually elongating only once by percurrent proliferation, up to 50μm long, 4-6μm wide, 5-8μm at the slightly swollen base. Conidiogenous cells integrated, terminal, monoblastic, pale brown to dark brown, cylindrical, truncate at the apex following conidium disarticulation. Conidia holoblastic, acrogenous, solitary, dry, variable in shape, obovoid to pyriform, often somewhat flattened apically and sometimes compressed sub-apically or laterally so as to give a somewhat lobed appearance, dictyosporous, with numerous septa arranged in a variable fashion, mostly longitudinal or oblique, with internal cells becoming stretched and elongated at maturity, brown to dark brown, evenly pigmented, smooth, thick-walled, seceding schizolytically, 26-57 × 19-30μm, with a distinctly protuberant, cylindrical, broadly truncate, 4-6μm wide, darker basal cell delimited by a transverse septum.

On bamboo; South America.

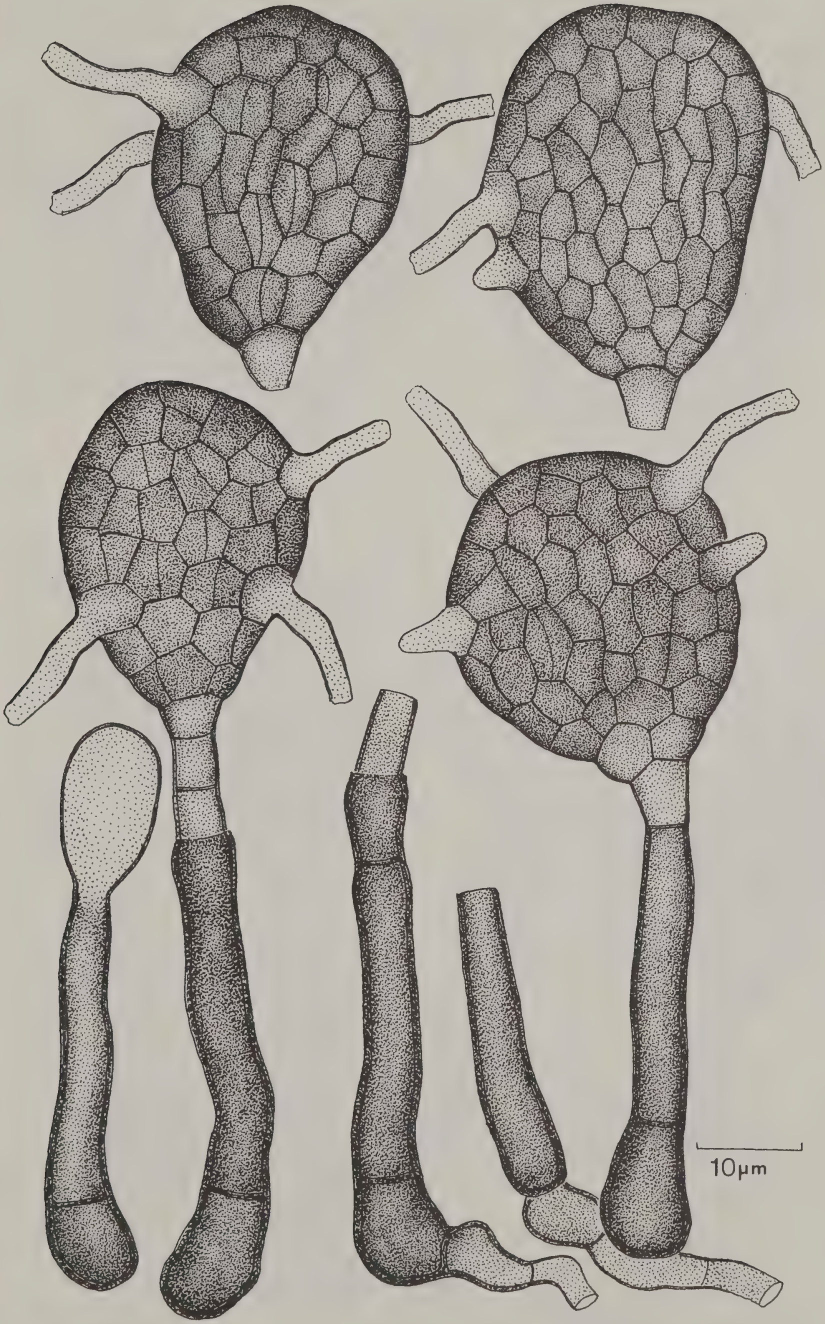

FIGURE 6. *Pseudoacrodictys eickerii*. Conidiophores and conidia.

Collection examined: on bamboo, El Avila, Venezuela, July 1958, R.W.G. Dennis [Flora of Venezuela 1136], IMI 80548a, holotype.

This species, although conforming to the essential generic charateristics in all other respects, differs from the other taxa in that the conidia lack appendages. Another distinctive feature is the notably cylindrical shape and denser pigmentation of the basal cell. With regard to internal conidial structure the tendency for cells toward the center to become compressed and disrupted, that is typical in the genus, occurs to a lesser extent in *P. dennisii* than in such species as *P. eickeri* and *P. viridescens.*

Pseudoacrodictys eickeri (Morgan-Jones) W.A. Baker & Morgan-Jones comb. nov. (Figure 6).

≡ *Acrodictys eickeri* Morgan-Jones, *Mycotaxon* 16:187, 1982.

Colonies effuse, brown to black. Mycelium superficial, partly immersed in the substrate, composed of branched, septate, pale brown to brown, smooth, 2-3μm wide hyphae. Conidiophores macronematous, mononematous, single, arising laterally from the hyphae, erect or ascending, straight or slightly flexuous, simple, smooth, thick-walled, cylindrical, aseptate or septate, brown to dark brown, indeterminate, usually elongating once or twice by successive percurrent proliferations, up to 40μm long, 2-3μm wide, 5-6μm at the swollen base. Conidiogenous cells integrated, terminal, monoblastic, pale brown to brown, cylindrical, truncate at the apex following conidium disarticulation. Conidia holoblastic, acrogenous, solitary, dry, broadly pyriform to somewhat turbinate, dictyosporous, with numerous septa arranged in an oblique fashion, with internal cells becoming progressively compressed and contorted toward maturity and ultimately often appearing disrupted, brown to dark brown, evenly pigmented, smooth, thick-walled, 38-64 × 22-42μm, seceding schizolytically, with a distinctly protuberant, cuneate, broadly truncate, 2-3μm wide basal cell delimited by a transverse septum; bearing 2-5 pale brown, somewhat undulate, hypha-like appendages laterally, or more often distally, 7-12μm long, which occasionally break or, when remaining intact, collapsed at the thin-walled tip to give a truncate aspect.

On decorticated twigs; Africa.

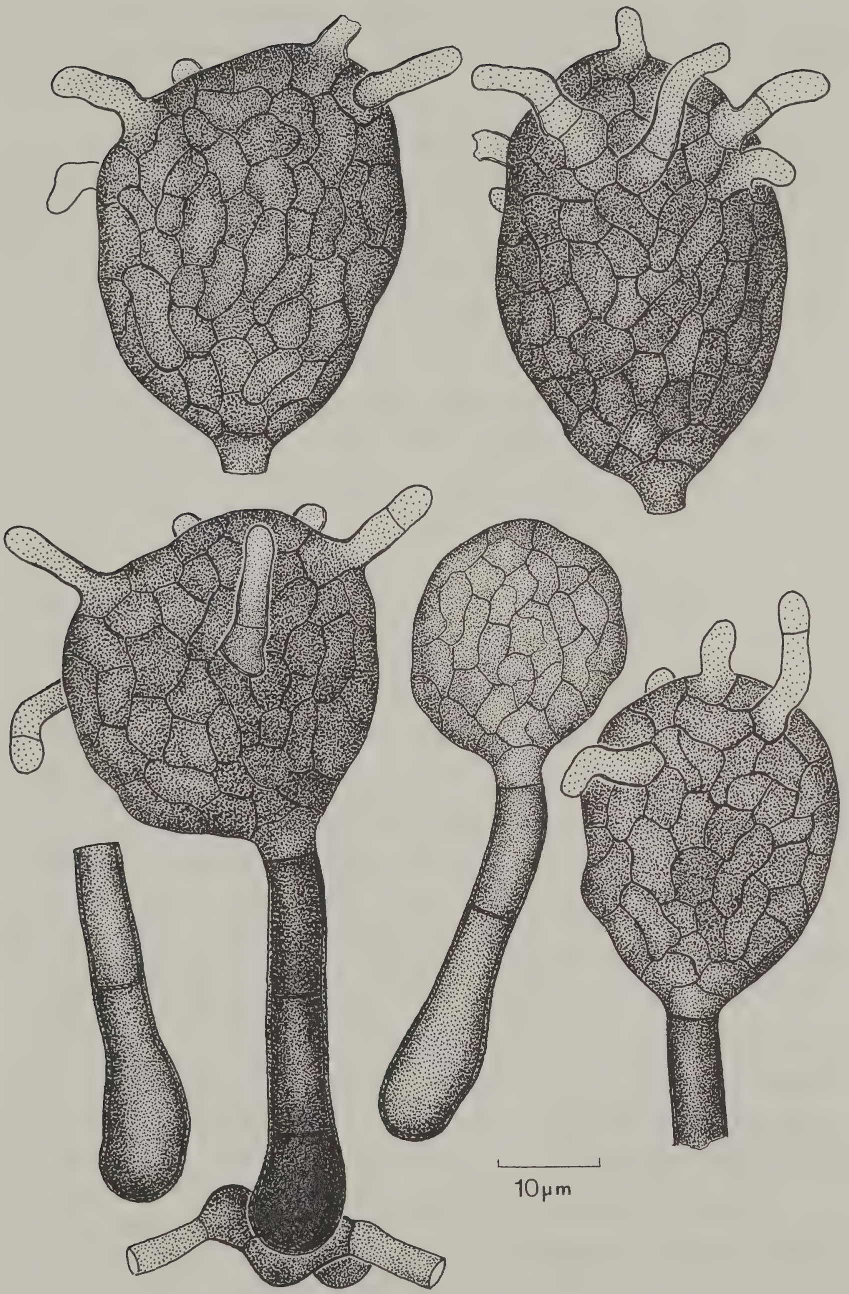

FIGURE 7. *Pseudoacrodictys viridescens*. Conidiophores and conidia.

Colletion examined: on decorticated twigs, Debengeni Forest Reserve, Magaebaskloof, N.E. Transvaal, Republic of South Africa, 17 August 1979, R.C. Sinclair, AUA, holotype.

Pseudoacrodictys eickeri is characterized by comparatively large conidia bearing hypha-like appendages, placed both distally and laterally. In the type and only known material many conidia appear desiccated giving a shriveled aspect with distorted and dilapidated internal cells. It is designated as the type species on account of the fact that it well exemplifies what are considered to be fundamental features by which the novel genus *Pseudoacrodictys* is conceptualized.

Pseudoacrodictys viridescens (B. Sutton & Alcorn) W.A. Baker & Morgan-Jones comb. nov. (Figure 7).

≡ *Acrodictys viridescens* B. Sutton & Alcorn, *Proc. R. Soc. Qd.* 95:45,1984.

Colonies effuse, dark brown to black. Mycelium superficial, partly immersed in the substrate, composed of branched, septate, pale brown to brown, smooth, 4-5.5μm wide hyphae. Conidiophores macronematous, mononematous, single, arising laterally from the hyphae, erect or ascending, straight or slightly flexuous, simple, smooth, thick-walled, cylindrical, septate, brown to dark brown, determinate, comparatively short, up to 38μm long, 5.5-7μm wide, 7-8.5μm at the swollen base. Conidiogenous cells integrated, terminal, monoblastic, brown to dark brown, cylindrical, truncate at the apex following conidium disarticulation. Conidia holoblastic, acrogenous, solitary, dry, subglobose to globose to broadly pyriform, dictyosporous, with numerous septa arranged in an oblique fashion and with cell walls markedly undulate to sinuate, giving a compressed aspect, brown to dark brown, evenly pigmented, smooth, thick-walled, 62-80 × 40-60μm, seceding schizolytically, with a distinctly protuberant, cuneate, broadly truncate, 5.5-7μm wide basal cell delimited by a transverse septum; bearing 4-10 pale brown, uncinate or curved, appendages distally 8-20μm long, which occasionally break or, when remaining intact, collapsed at the thin-walled tip to give a truncate aspect.

On dead unidentified twigs, *Archontophoenix* sp. [Arecaceae], and undetermined palm; Australia.

Collections examined: on dead twigs, Mt. Coot-tha, Queensland, Australia, 1 September 1981, B.C. Sutton & J.L. Alcorn, IMI 263538, holotype; IMI 263537, paratype; IMI 263540a.

In common with *P. deightonii* and *P. eickeri* the conidia of this taxon are appreciably larger than are those of the other species placed in the genus and appendage placement is similar to that in the latter. The appendages somewhat resemble those of *P. corniculata* in being often curved, but their distribution is scattered rather than localized. In addition to appendage morphology, *P. viridescens* can be distigushed from *P. eickeri* by conidial size and by lack of conidiophore proliferation. The internal structure of *P. viridescens* conidia was shown by Sutton and Alcorn (loc. cit.) to be composed of often parallel, agglutinated, thick-walled cells and the appearance described as 'textura oblita'. In this regard the structure was considered to be at variance with that of other species of *Acrodictys* where the cellular tissue was referred to as being of a 'textura angularis' type. Although the inner conidial cells of *P. viridescens* appear to be more tightly compressed, and thereby more elongated, than is the case in the other taxa classified within *Pseudoacrodictys* herein, there does not, however, appear to be any fundamental difference in the internal nature of the conidia.

DISCUSSION

Among the taxa included in *Pseudoacrodictys*, five bear a degree of morphological similarity that is, in all likelihood, indicative of close phylogenetic relatedness. The remaining two species, namely *P. brevicornuta* and *P. deightonii*, which differ in some respects, may be examples of evolutionary convergence and their true affinity may, therefore, lie elsewhere. It seems appropriate, however, given the state of current knowledge and the extent of the apparent resemblance to accommodate these outlying taxa within the new genus.

With regard to percurrent proliferation in relation to serial conidiation and somatic regenerative conidiophore growth, some degree of variation exists among the species of *Pseudoacrodictys*. The differences that occur, however, are not considered to be necessarily reflective of phylogenetic distance although, in the case of the presence of barrel-shaped extensions in *P. deightonii,* this may indicate relatedness discontinuity. The fact that, in this species, an ampulliform distal unit of the conidiophore may remain attached to the conidium at the time of release may be further indicative of possible heterogeneity. Likewise, in the matter of conidium detachment where some differences in the disarticulation process may occur between or even within a given species. For example, in *P. corniculata* and *P. viridescens*, conidia which normally secede by a schizolytic split in the delimiting septum may be released by an irregular tear in the proximal conidiophore periclinal wall. The latter phenomenon is not, however, comparable to the condition seen in species of *Rhexoacrodictys* [see Baker *et al.*, 2002a] where the rhexolytic circumscissile break which releases the conidia occurs evenly at a narrow, well-defined zone of dehiscence.

In addition to the entities treated in the present publication, there remain a number of anomalous taxa still classified in *Acrodictys* that bear conidia of somewhat similar morphology but which are undoubtedly misplaced in the genus. Among these are *Acrodictys kamatii* Narendra & V.G. Rao, *A. malabarica* Subram. & Bhat, and *A. stilboidea* J. Mena & Mercado. The first of these [see Narendra and Rao (1973)], which is known from a collection made in India on dead leaves of *Actinodaphne hookerii* Meissn., forms what appear to be chlamydospore-like clusters of cells which are referred to as conidia and is of doubtful identity. The second, found on bamboo, also in India, bears distinctly verrucose, gangliar conidia terminally and on short, lateral conidiophore branches [see Subramanian and Bhat (1987)]. Its strikingly unique morphology leads the present authors to suspect that it might best be reclassified in yet another segregate genus. The third is readily distinguishable from *Acrodictys sensu stricto* by the fact that its conidiophores are tightly synnematous [see Mercado and Mena (1986)]. Although the conidiogenous cells were described in the original treatment as being percurrent, no indication was given of the presence of successive terminal, lageniform to doliiform proliferations, of the type typical of *Acrodictys*. A further difference lies in the fact that the conidia of *A. stilboidea* are, except for a paler basal cell, uniformly olivaceous-brown in color and do not show the kind of gradual pigmentation-intensity gradation from a dark upper region to a lighter lower portion which is a characteristic of those species retained by Baker *et al.* (2002b) in *Acrodictys*. The appropriate taxonomic fate of these species remains to be further evaluated if and when type material becomes available for examination. Attempts to obtain such on loan have, thus far, been unsuccessful.

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STUDIES ON LACTARIUS: A NEW COMBINATION AND TWO NEW SPECIES FROM MEXICO

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ABSTRACT

Two undescribed *Lactarius* species in subgenus *Piperites* have been found in Mexico: *L. cristulatus* and *L. atroviolaceus*. Both are described here and compared with related species. In addition, after a type study of *L. uvidus* var. *montanus* from U.S., the new combination *L. montanus* is proposed. The particular set of characters with regard to basidiomes color and basidiospores (size, shape and ornamentation), supports its segregation from *L. uvidus* and allied taxa.

Keywords: Russulales, type study, taxonomy.

INTRODUCTION

Members of the genus *Lactarius* are among the most commonly encountered ectomycorrhizal agarics in conifer and broad-leaved forests in Mexico. Morphologic descriptions of *Lactarius* species in Mexican literature, when available, are often based on macroscopic features and indications of the specimens on which the references rely are practically absent. As a consequence of the lack of documentation of the species (morphology, illustrations and/or critical discussions), a broad sense of the taxonomic interpretation of members of the genus has prevailed in the Mexican literature. This fact was one of the significant factors encouraging research into populations of *Lactarius* in Mexico. A continuing examination of the available herbarium collections related with the reports, has revealed that most correspond to other taxa, and only a small number of species cited in early mycofloristic works are confirmed as present in the Mexican *Lactarius* biota (Montoya 1994, 2000; Montoya *et al*. 1990, 1996, 1998a,b,c; Montoya and Bandala 1996).

In the present study, fresh and herbarium collections of Mexican members of subg. *Piperites* (Fr.) Kauffmann (after Heilmann-Clausen *et al.* 1998; Basso 1999) were examined. This has provided the opportunity to analyse the morphological variation of the specimens, and to compare them with both U.S. and European collections. The results of such revision are the subject of this paper.

MATERIALS AND METHODS

Thirty-eight fresh and herbarium samples of *Lactarius* were studied. Most were gathered in Mexico, a few are collections from Europe and U.S., including the type specimen of *L. uvidus* var. *montanus* from Idaho. Macroscopic descriptions are based on the study of fresh material. Color codes indicated in the descriptions are based on Kornerup & Wanscher (1978). Microscopic structures are described from hand sections of revived tissues. Measurements and colors of the structures were observed in 3%

KOH, except for the basidiospores, which were studied in Melzer´s reagent. These latter were measured in side view, dimensions of the basidiospores excluding ornamentation and height of the ornamentation were considered separately. When estimating spore dimensions part of the recommendations by Heinemann and Rameloo (1985) were used. 25-30 spores per collection were evaluated selected at random from hymenial tissues. The first range reported in the descriptions is to describe the variability within the collections. Extreme values are indicated in brackets (highest values ±2 SD in each sample). The means of spore length (L), width (W) and quotient Q (ratio of basidiospore length/basidiospore width) were calculated in a single element of the collection. **RM** corresponds to the range of means of length and width of the collections. Similarly when more than one collection was examined, **Q'** refers to the range of the mean values of Q in such collections. Line drawings were made with the aid of a drawing tube. For scanning electron microscope (SEM) preparations, pieces of lamellae from the dried specimens were rehydrated in ammonia and afterwards fixed in glutaraldehyde. The pieces were critical point dried in acetone in a Polaron critical point dryer, and sputter-coated with gold. Herbarium acronyms are according to Holmgren *et al.* (1990) and Holmgren and Holmgren (1995).

RESULTS

A study of specimens related to the group of *Lactarius pyrogalus* (Bull.: Fr.) Fr. revealed the presence in Mexico of an undescribed species. The new species, *Lactarius cristulatus*, is an inhabitant of the mesophytic forests located in the central part of the Gulf of Mexico region (State of Veracruz). In the sites where *L. cristulatus* was found, basidiocarps were more less common near members of *Carpinus caroliniana* L. Walter (single trees or mixed with other broad-leaved elements, such as *Quercus* or *Liquidambar*), which probably indicates their ectotrophic association. A study of specimens of the two most closely related species (*L. pyrogalus* and *L. circellatus* Fr.) was the basis supporting the taxonomic position of Mexican specimens in subgenus *Piperites*. The distinctive macro and microscopic characters of each species are summarized below, and a complete description and a discussion of *L. cristulatus* is provided.

Based on a type study of *L. uvidus* var. *montanus* Hesler & A.H. Sm. (1979), and on the revision of samples of *L. uvidus* Fr. and *L. luridus* (Fr.) S.F. Gray, we propose the segregation of var. *montanus* as an independent species. The examination of A.H. Smith 65642 (holotype of *L. uvidus* var. *montanus*), showed that its inclusion as a variety of *L. uvidus* is counterindicated by several relevant morphocharacters of the specimen. In fact, it resembles members of the *L. uvidus* “group”; but the observed combination of characters (basidiome color, both basidiospore size and shape, and pattern of basidiospore ornamentation), in our opinion, argues against its being placed in *L. uvidus*. Compared also with *L. luridus*, we concluded that Smith´s specimen belongs to a different taxon.

Although considered a rather well known species in Mexican literature, we concluded that *L. uvidus* has been misinterpreted [including the collections identified by Montoya *et al.* (1990)]. Like members of the *L. uvidus* “group”, basidiomes of Mexican samples determined as this species stain violaceous. However, they exhibit a consistent set of macro- and micromorphological features, which we found to be different from the European *L. uvidus* and allied taxa. The combination of characters observed in these

Mexican specimens is consistent and supports interpretation of the collections as representing an independent taxon described herein as *L. atroviolaceus*. It is a common species found in several areas of Mexico, in *Pinus* forests or in mixed forests of conifers and *Quercus*. *Lactarius atroviolaceus* is apparently ectotrophically associated with *Pinus patula* Schlecht. & Cham., *P. montezumae* Lamb, *P. teocote* Schiede & Deppe ex Schlecht. & Cham. and *P. leiophylla* Schiede & Deppe ex Schlecht. & Cham.

DESCRIPTION OF THE SPECIES

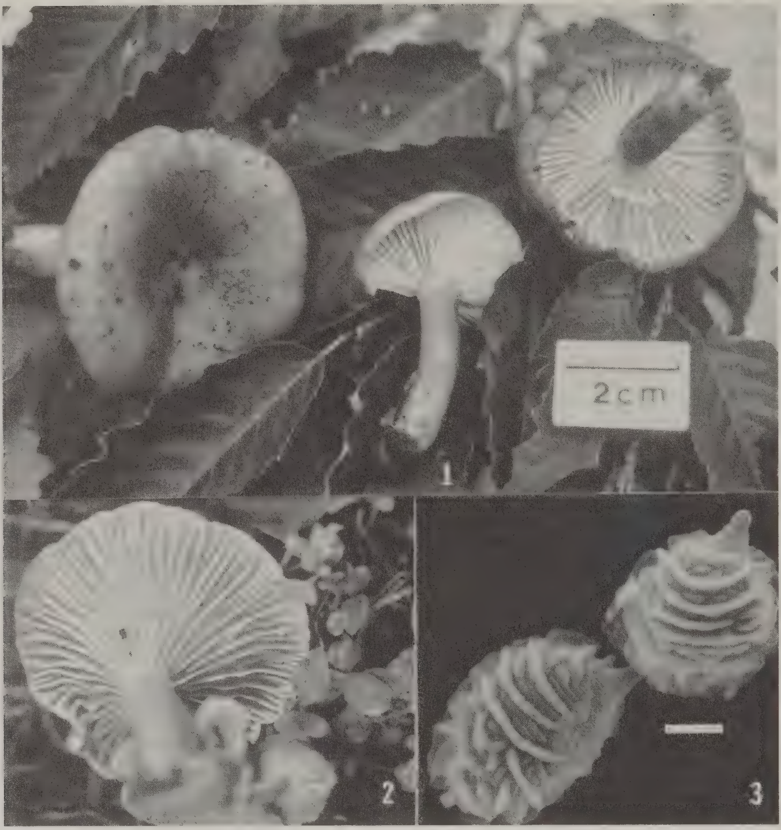
Lactarius cristulatus Montoya et Bandala ***sp. nov.***

Figs. 1-9

Pileus 25-70 mm latus, plano-depressus vel subinfundibuliformis, viscidus, brunneo-olivaceus, vel griseo-brunneus, atrobrunneo-olivaceus, concentrice zonatus margine striato vel sulcato. Lamellae adnatae ad decurrentes, distantes, luteoaurantiaceae. Stipes 35-70 x 8-15 mm, *cilindricus, pileo concolor vel pallide brunneo-olivaceus, viscidus. Caro griseoalbida vel pallida, sapore forti, piperato. Latex albidus, sapore forti piperato. Sporae* 6-8.8 (-9.6) x (4.5-) 5-6 (-6.4) µm, *ellipticae, cristulatae, zebratae, crestulis latiusculis praeditae,* 0.6 (-0.8) *µm altis, verrucis et crestulis brevibus isolatis. Pleurocystidia* 66-92 x 7.2-10.4 µm, *subcylindracea vel ventricosa, numerosa. Cheilocystidia* 32-47 x 4-8.8 µm, *subcylindracea vel subclavata. Epicutis gelificata, hyphis filiformibus implicatis constituta. Holotypus*: *lectus prope Mexico. Veracruz, Mpio. Xalapa, SW Xalapa, ca. Coapexpan River, 7.VII.1995, Montoya 3207 (XAL).*

Pileus 25-70 mm wide, plane, convex, depressed to subinfundibuliform, viscid, with adnate fibrills, greyish black with olivaceous (4E2-E3) tinges, greyish brown, drab (5C5-E3) dark brown (6E4-6F4) with olivaceous tinges (5C3-B3, 5F7-F8), with greyish brown (5C2) concentric zones, margin decurved, finely striate to sulcate. Lamellae adnate to decurrent, distant, broad, yellowish (4A3, 5B2-B4) to yellowish orange (5A4-B4) at times with pinkish tinges (5A2). Stipe 35-70 x 8-15 mm, cylindric, slightly paler than pileus, greyish brown (5B2-D2), pale grey with olivaceous tinges, at times with superficial darker spots (not decidedly scrobiculate), viscid to subviscid, glabrous. Context greyish white with pinkish to brownish tinges; odor mild to pleasant; taste very acrid. Latex white, invariable, very acrid.

Basidiospores 6-8.8 (-9.6) x (4.5-) 5-6 (-6.4) µm; **RM** = 7-7.8 x 5.4-5.7 µm; **Q'** = 1.26-1.38; broadly ellipsoid to subellipsoid, ornamentation 0.6 (-0.8) µm high, cristulate, ridges enlarged and arranged in a so-called "zebroid" pattern; under SEM ridges appearing with regular margin, oriented in parallel bands approximately encircling basidiospore, interrupted ridges and warts also present, these latter more or less oriented in parallel rows. Basidia 66-88 x 7.2-10.4 µm, clavate, tetrasporic. Pleurocystidia 66-92 x 7.2-10.4 µm, subcylindric to ventricose, apex rounded or at times attenuated, frequent. Cheilocystidia 32-47 x 4-8.8 µm, subcylindric to ventricose, subclavate. Pileipellis an ixocutis, 80-200 µm broad, hyphae 1.6-4 µm wide, loosely interwoven and more or less with periclinal orientation, at times with segments of terminal hyphae projecting (anticlinal), in some areas mounds of suberect hyphae present. Context with sphaerocytes of 16-24 µm wide, hyphae 3.2-4.8 µm wide, laticiferous hyphae 4.8-8.8 µm wide. Hymenophoral trama with hyphae 1.6-4.8 µm wide, laticiferous hyphae 6.4-8 µm wide.

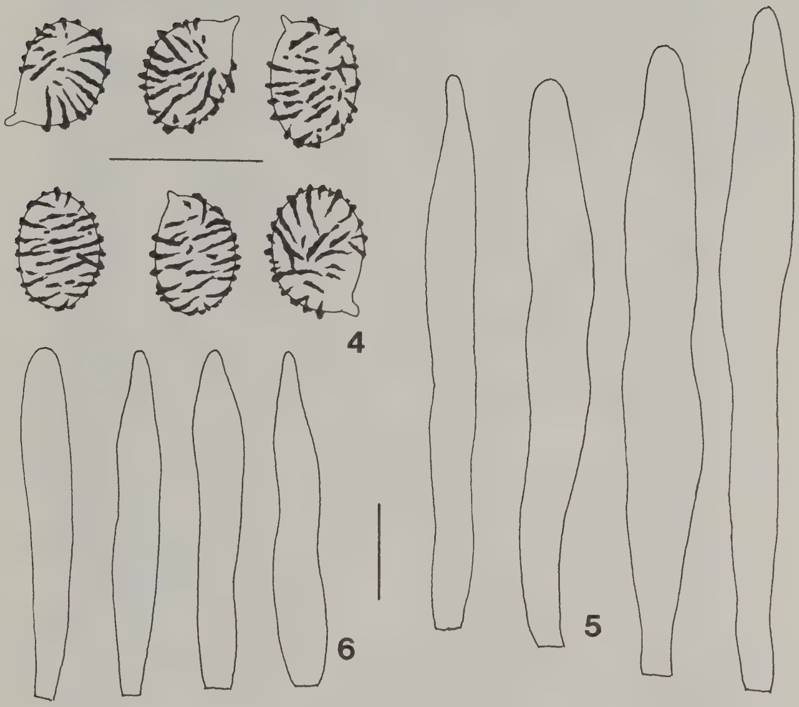


Figs. 1-3. ***Lactarius cristulatus*****. Figs. 1-2**. Basidiomes. **Fig. 3.** Basidiospores under SEM (scale bar = 2 µm) (Montoya 3207).

Habitat. Solitary, in soil, in mesophytic forest.

Material studied. MEXICO. Veracruz: Mpio. de Banderilla, SW Banderilla, Rancho La Pomarrosa, 16.VI.1984, Anell 130. Mpio. de Xalapa, SW Xalapa, near Coapexpan River, 1.VI.1986, Bandala 792a; 1.VI.1986, Montoya 564; 17.IX.1986, Montoya 783; 7.VII.1995, Montoya 3206, Montoya 3207 (holotype). Old Xalapa-Coatepec road, around Instituto de Ecología, 27.VIII.1991, Tapia 850; 1.IX.1993, Montoya 2163, Montoya 2164. Old Xalapa-Coatepec road, Jardín Botánico Fco. J. Clavijero, 13.X.1983, Chacón 1734; 23.VI.1986, Anell 461; 14.X.1986, Chacón 3892; 23.VI.1997, Tapia 1706. Old Xalapa-Coatepec road, Parque Ecológico Fco. J. Clavijero, 15.VII.1982, Brown 511; 19.V.1989, Chacón 4132; 19.IX.1986, Medel 76; 13.VI.1986, Montoya 611. Mpio. de Xalapa, km 1 old Xalapa-Coatepec road, 10.VI.1991, Murrieta 489 (all in XAL).

Other material studied. *Lactarius circellatus*. Denmark: Kolding, Marielund, 2.VIII.1991, J. Vesterholt JV 91-244 (C). Italy: Reggio Emilia, 02.07.1997, G.P.



Figs. 4-6. ***Lactarius cristulatus*****. Fig. 4.** Basidiospores**. Fig. 5.** Pleurocystidia**. Fig. 6**. Cheilocystidia (Montoya 3207) (scale bar = 10μm).

Simonini (private herbarium). Norway: Oslo, Nordre Gravlund, 13.IX.1980, S. Traavik 869; Østfold, Kråkerøy, 10.IX.1973, W. Ramm s.n.; Buskerud, Hurum, 21.VIII.1978, S. Kristoffersen 174/78 (all in O). Spain. Segovia: around Riaza, 25.VI.1997, Montoya 3416 (XAL). *Lactarius pyrogalus*. Belgium: Namur, Heure-en-Famenne, domein Jalna, 22.X.1995, Walleyn 435 (private herbarium). France: Le Pré-Vieux, La tour de Salvagny (Rhône), 9.IX.1938, M. Josserrand s.n. (MICH). Spain. Catalunya: Cantonigros, 14.X.1997, Montoya 3427; Rupit, 13.X.1998, Montoya 3447 (both in XAL). Sweden: Vastergötland, Gøteborgs Bot. Trädgård, Naturparken, 16.9.1960, Karlvall 9650 (GB).

This species is distinguished by the following set of characteristics: i) basidiomes with a medium to dark greyish-brown color and with olive tinges, ii) distant lamellae, iii) size and shape of basidiospores, and iv) with a notable "zebroid" appearance due to the ornamentation, composed of enlarged parallel ridges. The European *L. circellatus* and *L. pyrogalus* both exhibit cristulate basidiospores; but each presents a characteristic combination of features differing from those of *L. cristulatus*, especially with regard to basidiospores (shape, size and particular arrangement of ornamentation) and the basidiomes (habit, color, including lamellae disposition).

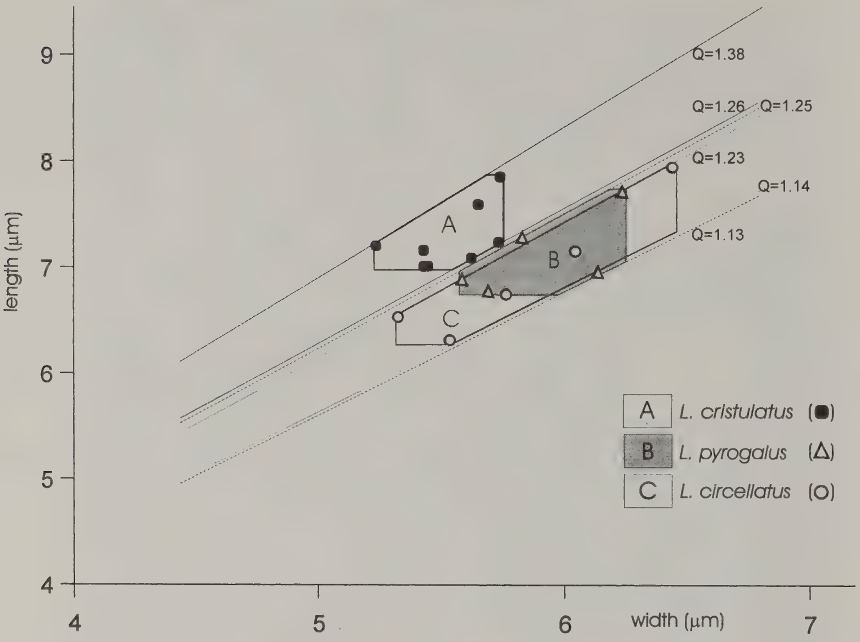
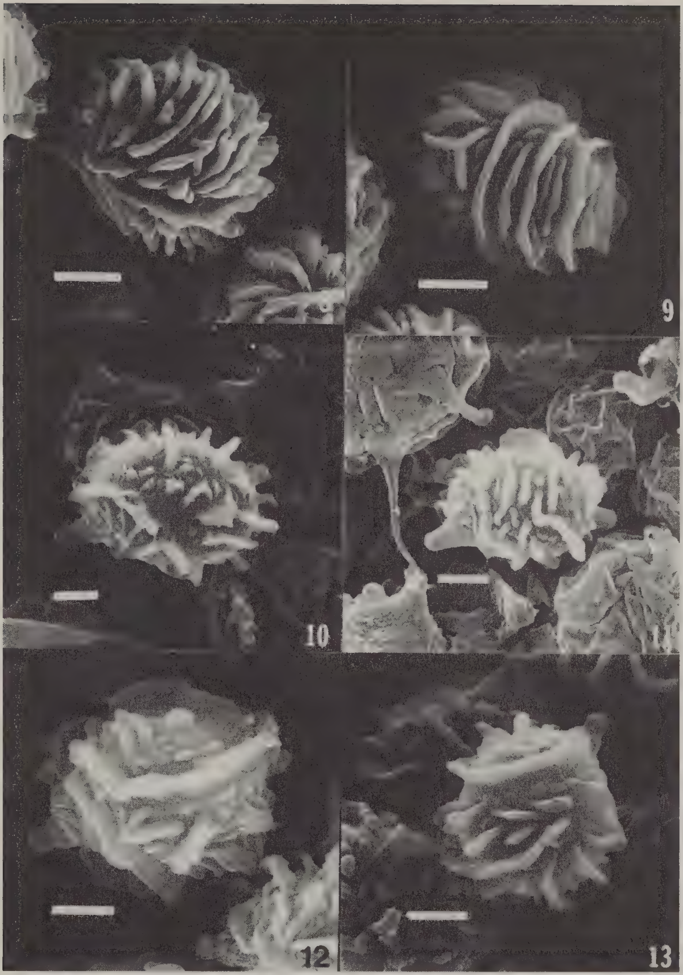


Fig. 7. Distribution of basidiospore size of specimens of ***L. cristulatus***, ***L. circellatus*** and ***L. pyrogalus***. The symbols in the sporograph represent the means of spore length and width of different collections of each species, and the lines indicate different values of coef. Q. The regions defined by the mean spore dimensions and mean Q of available collections of each taxon are represented by differently shaded polygons.

Basidiomes of fresh specimens examined of *L. pyrogalus* (Montoya 3427, 3447) showed lighter colors (5A2-5D3) and the lamellae were closer than in *L. cristulatus*. The basidiospores consistently present an ornamentation pattern bearing narrow interrupted ridges and isolated warts (figs. 10-11). The spore shape in the examined collections is more nearly globose than in Mexican samples, with a **Q'** = 1.13-1.25 (6-8 x 5.6-6.4 µm, **RM** = 6.8-7.3 x 5.6-6.2 µm) (fig. 7). Josserrand (1940), Llistosella (1997) and Heilmann-Clausen *et. al* (1998) reported a similar set of features for other European collections of *L. pyrogalus*. The sporograph of fig. 7 displays the distribution of the mean values of the basidiospore dimensions of *L. circellatus*, *L. cristulatus*, and *L. pyrogalus*. The polygons in the sporograph are determined by the limits of the means values of length, width and Q obtained in the examined samples of the three taxa, following the technique of Tulloss (1984). The sporograph presents more clearly the ease of segregating *L. cristulatus* from the other two taxa based on spore size and shape. Likewise, the graphical presentation makes it clear that the same characters alone are not useful in separating *L. circellatus* from *L. pyrogalus*.

Under the name *L. pyrogalus*, Homola and Czapowskyj (1981) presented a picture of a North American specimen which, according to the habit, color and disposition of lamellae, resembles the new taxon described here. The basidiospore ornamentation as shown in the SEM photographs by Homola and Kimball (1975) and Homola and Weber



Figs. 8-13. *Lactarius* basidiospores under SEM. **Figs. 8-9.** ***L. cristulatus*** (Montoya 3207). **Figs. 10-11.** ***L. pyrogalus*** (Walleyn 435). **Figs. 12-13.** ***L. circellatus*** (Montoya 3416) (scale bar = 2 µm).

(1979) of specimens assigned to *L. pyrogalus*, differs from that reported for European specimens but agrees with that exhibited by basidiospores of *L. cristulatus*. Hesler and Smith (1979) found the basidiospore ornamentation of the American specimens they placed in *L. pyrogalus* to be different from that of European specimens. The photographs of the basidiomes of *L. pyrogalus* sensu Hesler & A.H. Sm. also recall *L. cristulatus*. The presence of *L. cristulatus* north of Mexico, however, should be corroborated with new, fresh collections. We studied some herbarium samples assigned to *L. pyrogalus* in Hesler and Smith (1979) [USA. Michigan: Washtenaw Co., A.H. Smith 72634; Cheboygan Co., A.H. Smith 32670; Ann Arbor, Kauffmann 1345. New

York: Tompkins Co., Shaffer 471. Tennessee: Great Smokey Mt. National Park, A.H. Smith 7323 (all in MICH)]. These and Mexican specimens share most of their distinctive microcharacters (and similar variation of habit and lamellae disposition even in dry condition) which suggests to us that they correspond to the same taxon. Nevertheless, macroscopic characters in the American specimens were not fully described (as emphasized also by Hesler and Smith *op. cit.*) so they could only be tentatively placed close to *L. cristulatus*.

The combination of characters that distinguish *L. circellatus* from *L. cristulatus* includes the basidiospore characteristics, the habit and color of the basidiomes and features of the lamellae. As noted by Llistosella (1997) and Heilmann-Claussen *et al.* (1998) the basidiospores of *L. circellatus* are subglobose. Our study of the materials of *L. circellatus* revealed basidiospores with a **Q'** = 1.14-1.23 [5.6-8 x 4.8-7 (-7.2) µm; **RM**= 6.3-7.9 x 5.3-6.5]. The basidiospore ornamentation in these collections is also distinctive, bearing frequent narrow ridges and warts (figs. 12-13). Furthermore the basidiomes of *L. circellatus* have a short and thick stipe, and a broad pileus (Llistosella 1997; Heilmann-Claussen *et al.* 1998; Basso 1999), thus having a more compact (even robust) and fleshy appearance. For example, the basidiomes of *L. circellatus* in the collection Montoya 3416 (from Spain) included a pileus range of 50-100 mm and stipe 25-55 x 10-25 mm. Other differences are the lighter colour of the basidiomes (4C2-5C2 in the Spanish specimen) and paler, shorter, crowded and adnate lamellae.

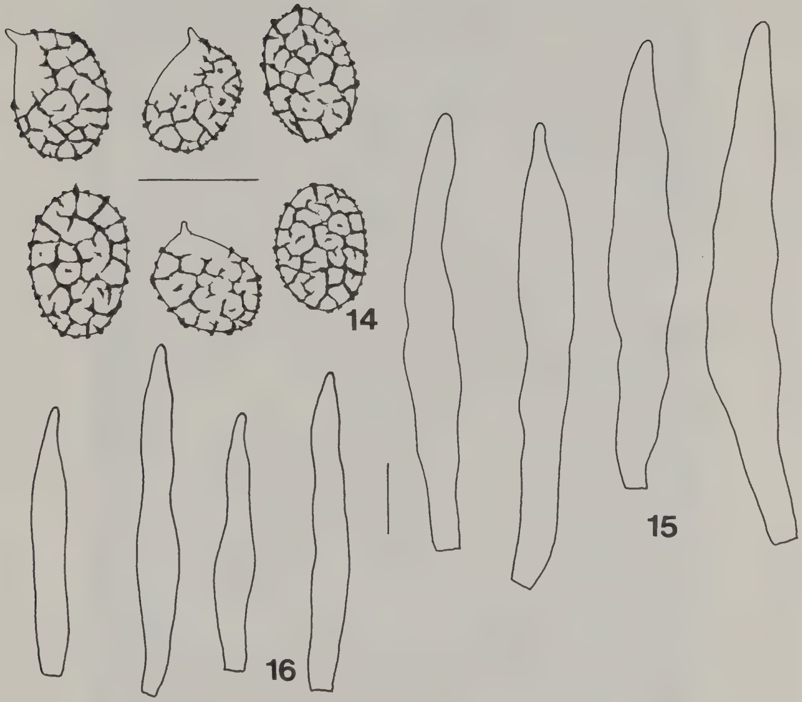
Lactarius montanus (Hesler & A.H. Sm.) Montoya & Bandala ***comb. nov.***

Figs. 14-18

Basionym: *Lactarius uvidus* var. *montanus* Hesler & A.H. Sm., *N. Amer. Species Lactarius*, p. 340, 1979.- Holotypus: USA. Idaho: Stanley, under conifers, 31.VII.1962, A.H. Smith 65642 (MICH).

For descriptive information see Hesler and Smith (1979). Basidiomes of this taxon stain violaceous and therefore recall those of *L. uvidus* (var. *uvidus*). However, after a reexamination of the holotype of var. *montanus*, we found that the specimen A.H. Smith 65642 exhibits a set of characters that taxonomically separates it from *L. uvidus*. The var. *montanus* as described by Hesler and Smith (1979) and latter interpreted by Methven (1997) is recognized here as an independent species: i) having darker basidiomes than the European *L. uvidus*, "...purple drab to light vinaceous drab (purplish umber to grayish vinaceous or dark vinaceous brown)..." (Hesler and Smith 1979), or "...greyish red (8C4) to reddish brown (8D4) or dull red..." (Methven 1997), ii) the basidiospore shape, which tends to be more ellipsoid than in the European taxon; in A.H. Smith 65642 we calculated a Q = 1.39 [(7.2-) 8-10.4 x (5.6-) 6.4-7.2 µm; L x W= 9.2 x 6.6], and iii) the basidiospore ornamentation, composed of a partial to complete reticulum, made of almost continuous, articulated, low bands 0.4 (-0.8) µm high (figs. 14, 17-18). In the type specimen of *L. uvidus* var. *montanus*, the pileipellis is intermediate between an ixocutis and an ixotrichodermis (65-110 µm deep), with hyphae having dense intracellular pigmentation, coagulated when observed in water or as dense intracellular contents in KOH.

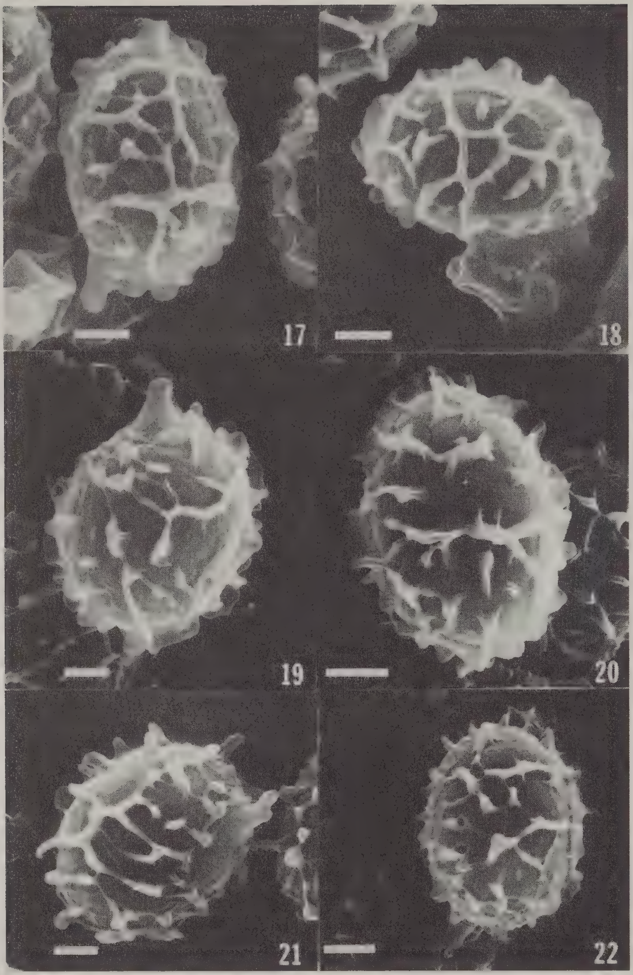
Our interpretation of *L. uvidus* is based on specimens with pale greyish brown to pinkish buff pileus with lilac tinges (material from Italy: Reggio Emilia, near Marola, 28.IX.1996, Montoya 3369, XAL). European authors, following the concept of Fries



Figs. 14-16. ***Lactarius montanus***. **Fig**. 14. Basidiospores. **Fig. 15.** Pleurocystidia. **Fig. 16.** Cheilocystidia (scale bar = 10µm) (A.H. Smith 65642).

(1815), reported *L. uvidus* with "...pale pinkish buff to clay-pink, clay-buff, greyish-pink, pale mouse-grey, pale vinaceous or light vinaceous grey..." (Heilmann-Clausen *et al*. 1998), "... molt pàllid i uniforme, gris rosat a beix lilací..." (Llistosella 1997), or "...crema lilacino, lilacino-giallognolo livido, lilacino grigiognolo, grigio-vinaceo, bruneo-grigiognolo pallido, crema-grigiognolo, talvolta macchiato di crema-ocraceo, più scuro al disco..." (Basso, 1999). The basidiospores in the studied collections of *L. uvidus* were subglobose to broadly ellipsoid, with Q = 1.30 [9.2-11.2 (-12) x 7.2-8 µm, L = 9.8 x W= 7.6] in specimen Christensen AV97-574 from Sweden (GENT), Q = 1.28 [9.6-11.2 x 7.2-8 (-8.8) µm, L = 10.17 x W = 7.9] in the collection Montoya 3369 or **Q'**= 1.20-1.32 (8.4-11.3 x 6.6-8.5 µm, **RM** = 8.9-9.8 x 7.3-7.9) according to the data in Heilmann-Clausen *et al.* (1998). A SEM study of the collection of Christensen 97-574 revealed that the basidiospores exhibit a cristulate ornamentation pattern, with disarticulate warts and ridges rarely connected forming partial nets, 0.8-1 µm high (figs. 19-20). Llistosella (1997), Walleyn *et al.* (1998) and Heilmann-Clausen *et al.* (1998) described and illustrated a similar type of basidiospore ornamentation in the collections of *L. uvidus* that they studied.

Lactarius montanus was compared with *L. luridus*. Basidiome color of this latter species is different "...clay-buff, greyish brown, umber or fawn, sometimes with umber, dark brick coloured, vinaceous grey or pale mouse grey spots..." (Heilmann-Claussen *et*



Figs. 17-22. *Lactarius* basidiospores under SEM. **Figs. 17-18.** ***Lactarius montanus*** (A.H. Smith 65642). **Figs. 19-20.** ***L. uvidus*** (Christensen 97-574). **Figs. 21-22.** ***L. luridus*** (Verbeken 96-992) (scale bar = 2 µm).

al., 1998), or "…crema-grigiastro, grigio-bruno-violaceo pallido..." with spots presence and paler lamellae "biancastro-crema pallido" (Basso, 1999). *Lactarius luridus* has been reported to have basidiospores, with a **Q'** = 1.19-1.24 (7.8-11.3 x 6.4-9.6 µm, RM = 8.6-9.7 x 7.0-8.1) (Heilmann-Clausen *et al.*, 1998) [8-11 x 7-8.5 µm, according to Basso (1999)]; in a specimen from Denmark (East Jylland, Verbeken 96-992, GENT), we found the basidiospores to have Q = 1.28 [8.8-12 (-12.8) x 7.2-8.8 (-9.6), L x W = 10.27 x 8], which along with the above information suggests us that in *L. luridus* the basidiospores tend to be more globose than in *L. montanus*. In addition, the basidiospores in *L. luridus* bear elevated ridges, 0.8-1.2 µm high, projecting from thin and low bands (figs. 21-22). This ornamentation pattern was described as "crestato-reticolata" by Basso (1999). Regarding ecological distribution, *L. luridus* as well as *L. uvidus* occur under broadleaved trees.

Lactarius atroviolaceus Montoya et Bandala ***sp. nov.***

Figs. 23-30

Pileus 30-100 mm *latus, convexus plano-convexus, demum plano-depressus, umbonatus vel acute papillatus, azonus vel subzonatus, viscidus, rubro-brunneo, brunneo-violaceus, atro-vinosus ad atro-violaceus, vel brunneus, margine incurvo. Lamellae confertae vel confertiores, adnato-subdecurrentes, cremeo-flavidae, violacens. Stipes* 40-90 x 8-19 (-22) mm, *cilindricus vel obclavatus, albido usque ad pallide brunneum vel pileo concolor, violacens, subviscidus. Caro albida usque ad cremeum, violacens, sapore amaro. Latex albo usque ad cremeum. Sporae* 8.8-12.8 x 6.4-8 μm, *ellipticae, reticulatis sub-reticulatis, crestulis* 0.6 (-0.8) μm *altis praeditae. Pleurocystidia,* 56-104 x 5.6-12.8 μm, *subfusiformia, sub-cylindracea, subventricosa. Cheilocystidia* 38-76 x 5.6-8.8 μm, *sub-cylindacea, sub-fusiformia. Epicutis gelificata, hyphis filiformibus implicatis,* 124-240 μm *latis constituta, pigmento extracellulare et intracellulare adest. Holotypus: lectus prope México. Tlaxcala, Mpio. Huamantla, NE Volcán La Malintzi, Parque Nacional La Malinche, IX.1994, Montoya 3118 (XAL).*

Pileus 30-100 mm wide, convex to plano-convex or finally plane and centrally depressed, umbonate, more frequently with an acute papilla, dark violet brown, dark vinaceous brown, reddish brown (8E6-12E8, 10F8-12F8) to brown (7D6) when paler, generally azonate, at times with diffuse zonations, viscid, smooth to somewhat rugose; margin decurved, undulate, finely pubescent when young, becoming glabrous, paler than pileus center (tobacco brown to violet brown 9E8-11F6). Lamellae close to crowded, short (3-5 mm broad), adnate, yellowish white (1A3), staining lilac, magenta to violaceous (13C-14D4, 15E3-16E4) or dark violaceous (14F5) when cut or bruised. Stipe 40-90 x 8-19 (-22) mm, subcylindric to broadened towards the base, rugose, slightly fibrillose, whitish and superficially with pale brownish tinges (7C3-11B2 pale), pinkish to reddish (9A7-10A6), greyish brown or similar to the pileus (11D8-12D8), at apex concolorous with lamellae, staining violaceous when bruised, whitish towards the base, hollow, moist to subviscid, glabrous, base strigose. Context whitish to cream or ivory, beneath pileipellis with violaceous tinges, staining lilac, magenta to violaceous (13C4-14D4, 13-14E7, 17D-E4) when exposed, odor fungoid, taste bitter. Latex whitish to cream colour, at times whey-like, invariable but staining surfaces, cut areas and white paper violaceous to brown-violaceous. KOH green (27E-F8, 28-29B5) on pileus and pale green on context of stipe.

Basidiospore print whitish to cream colour. Basidiospores 8.8-12.8 x 6.4-8 μm, (**RM** = 10.6-10.7 x 7.1-7.2 μm, **Q'** = 1.49-1.51), ellipsoid and at times weakly attenuated towards the apex, ornamentation 0.6 (-0.8) μm high, with an incomplete reticulum, some areas with broad mesh net; under SEM reticulum appearing more or less continuous, with bands frequently meeting in acute angles, ridges continuous, margin wavy or more or less regular, also unconnected warts and short bands present. Basidia 48-72 x 8-12 μm, clavate, tetrasporic or bisporic. Pleurocystidia 56-104 x 5.6-12.8 μm, subfusiform, subcylindric, sinuous, subventricose, attenuated towards base, apex at times constricted and mucronate, frequent. Cheilocystidia 38-76 x 5.6-8.8 μm, subcylindric, sinuous, subventricose, attenuated towards base, apex at times constricted

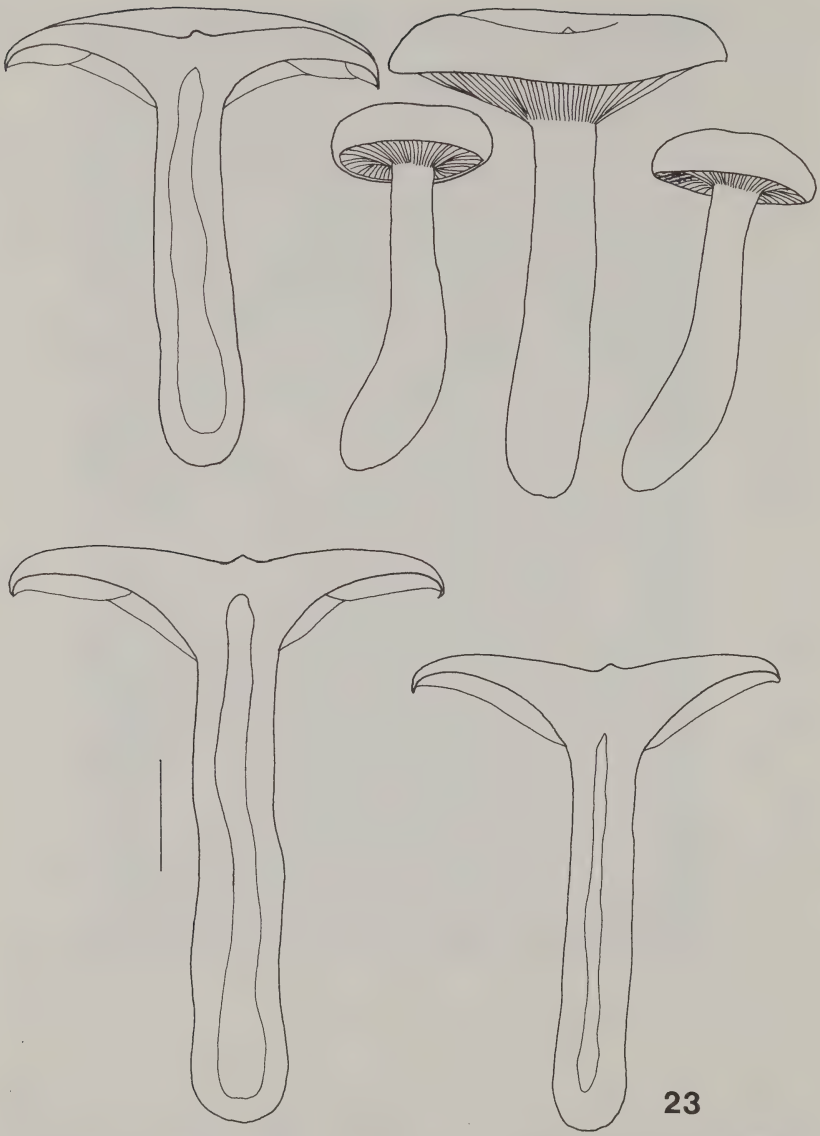


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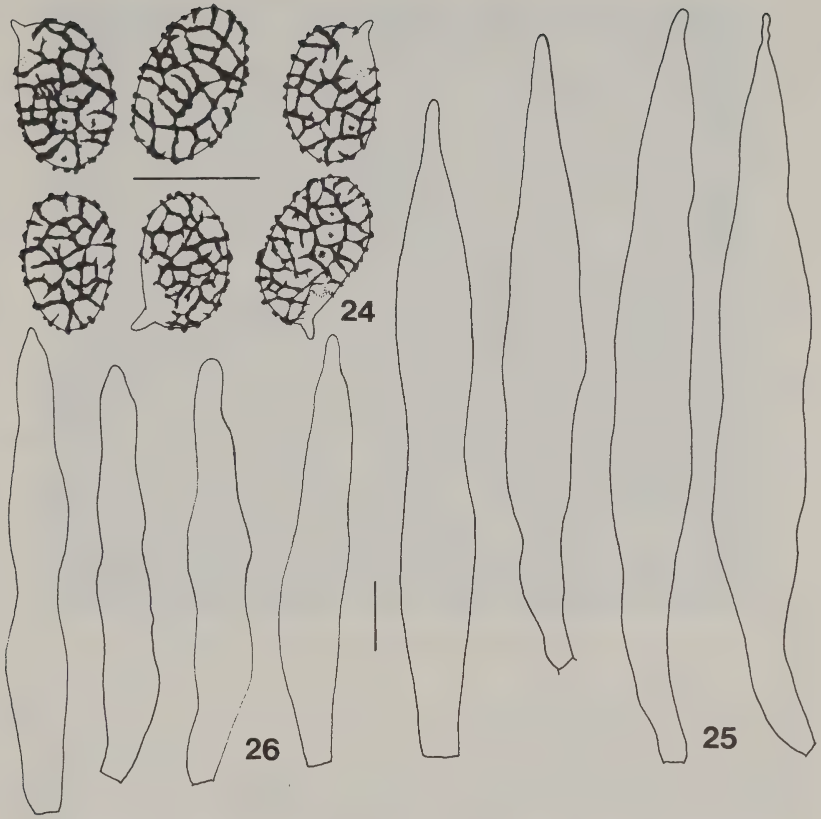
Fig. 23. Basidiomes of ***Lactarius atroviolaceus*** (Montoya 3118), scale (bar = 20mm)

and mucronate, frequent. Pileipellis as ixocutis, 124-240 µm thick, elements loosely arranged in thick gelatinous matrix, these at times somewhat decurved or oblique, hyphae 1.6-3.2 µm wide. Context hyphae 5.6-8 µm wide, laticiferous hyphae 7.2-9.6 µm wide, sphaerocytes 24-32 µm wide. Hymenophoral trama hyphae 4-8 µm wide, laticiferous hyphae 5.6-8 µm wide. Stipitipellis slightly gelatinized, a stratum 24-48 µm thick, hyphae 2.4-4 µm wide, more or less oriented as cutis, intermixed in some areas,



Figs. 24-26. ***Lactarius atroviolaceus*****. Fig. 24.** Basidiospores. **Fig. 25.** Pleurocystidia. **Fig. 26.** Cheilocystidia (Montoya 3118) (scale bar = 10 µm).

or somewhat projecting where gelatinization is not evident.

Habitat. Gregarious to subgregarious, in soil, in *Pinus* forests or mixed forests, *i.e. Pinus-Quercus* or *Pinus-Quercus-Abies*.

Material studied. MEXICO. Guerrero: Mpio. de Chilpancingo, La Cañada de Agua Fría, Omiltemi, 10.VII.1985, Villegas 371 (FCME). Querétaro: Mpio. Pinal de Amoles, San Juan del Río-Pinal de Amoles, 2.VIII.1985, Cifuentes 2100 (FCME).Tlaxcala: Mpio. de Huamantla, NE Volcán La Malintzi, Parque Nacional La Malinche, Nov.1994, Montoya 3118 (holotype); Nov.1994, Montoya 3119T (both in XAL); Mpio. de Tlaxco, El Rosario-El Rodeo, Cerro El Peñón, Nov.,1994, Montoya 3115T; Nov. 1994, 3116T (both in XAL); 12.VII.1992, Kong 2287; 14.VIII.1992, Kong 2406; 4.IX.1992, Kong 2458 (all in TLXM). Veracruz: Mpio. de Las Vigas, N Cofre de Perote, Las Vigas-El Llanillo, López 1488. E Cofre de Perote, S Tembladeras, Ejido Ingenio El Rosario, 28.VI.1985, Guzmán 28862 (both in XAL).

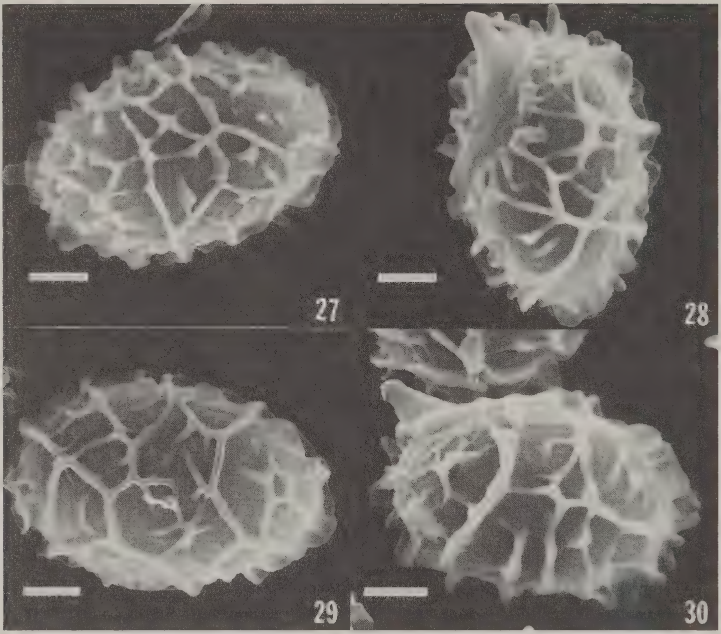


Fig. 27-30. ***L. atroviolaceus***, basidiospores under SEM (Montoya 3118) (scale bar = 2 μm).

This taxon was reported by Montoya *et al.* (1990) under the name *L. uvidus* based on some of the above specimens. There are, however, a number of differences between the collections from Mexico and those of *L. uvidus* discussed above (see discussion of *L. montanus*). The combination of characters unique to *L. atroviolaceus* that distinguish it from both *L. uvidus* and other related violaceous staining *Lactarius* species is: the dark vinaceous brown or dark violet brown pileus, papillate pileus, size and shape (ellipsoid) of the basidiospores, which bear a reticulate ornamentation pattern, and the thick ixocutis with the hyphae lacking intracellular pigments (even in water or in KOH).

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ADDITIONS TO OUR KNOWLEDGE OF THE GENUS GEASTRUM (PHALLALES: GEASTRACEAE) IN BRAZIL

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ABSTRACT - A study of the genus *Geastrum* occurring in Brazil was undertaken. Five species are discussed: *G. pectinatum*, *G. saccatum*, *G. schweinitzii*, *G. smardae* and *G. triplex*. A key and illustrations of basidiomata are given.

KEYWORDS - Basidiomycota, gasteromycetes, Neotropics, taxonomy.

INTRODUCTION

During a current taxonomic survey of the Brazilian gasteromycetes (Baseia & Milanez 2000; Baseia & Milanez 2001a, 2001b, 2001c, 2002a, 2002b, 2002c; Baseia & Galvão 2002), a study of some species of *Geastrum* Pers. was undertaken.

Geastrum is the main and largest genus of Geastraceae Corda and consists of eight additional genera: *Geasteropsis* Hollós, *Myriostoma* Desv., *Phialastrum* Sunhede, *Pyrenogaster* Malençon & Riousset, *Radiigera* Zeller, *Terrostella* Long and *Trichaster* Czern. (Sunhede, 1989). Upwards of more than one hundred names have been described in *Geastrum*, but according to Sunhede (1989) there are no more than thirty species in the genus. From Brazil, one finds sporadic studies, like Sydow & Sydow (1907), Rick (1910, 1930, 1961), Bononi *et al*. (1981, 1984), Kimbrough *et al*. (1995) and Baseia & Milanez (2002c).

MATERIALS AND METHODS

Fieldwork was based at the Ecological Station of Jataí (21°33′-21°37′S and 48°45′-48°51′W), Ecological Station of Itirapina (22°28′-22°30S and 48°17′-48°19′W) and the Biological Reserve of Moji-Guaçu (22°15′-22°16′S and 47°08′-47°-12′W), all located in the state of São Paulo; Biological Reserve of Serra Negra (8°38′-8°35′S and 38°02′-38°04′W), Biological Reserve of Saltinho (8°43′-8°45′S and 35°10′-35°10′W) and the Gurjaú Complex (8°21′30′′-8°12′S and 31°56′30′′-35°45′W), all lying in the state of Pernambuco.

Hand-cut sections of fresh and dried material were mounted for microscopical examination in 2% KOH, Melzer's reagent and lactophenol with cotton blue. Spore measurements include the ornamentation. Colour terms in parentheses are those of Kornerup & Wanscher (1978). Herbarium names are abbreviated according to the Index Herbariorum (Holmgren *et al*., 1990). Additional collections studied were loaned from ICN, JPB, PACA, SP, and URM. The material studied is preserved in SP and URM.

TAXONOMIC SECTION

Key of the species

1 Basidiomata small (up to 1 cm diam.), caespitose, base
attached to a whitish subiculum .... *Geastrum schweinitzii*
1' Basidiomata larger, not caespitose, without a subiculum 2
2 Endoperidium with basal apophysis and mouth sulcate .... *G. pectinatum*
2' Endoperidium without basal apophysis and mouth fimbriate 3
3 Exoperidium saccate, peristome whitish .... *G. saccatum*
3' Exoperidium revolute, peristome concolor 4
4 Exoperidium with part of the flesh layer forming a collar-like
structure around the endoperidium, spore ornamentation columnar .... *G. triplex*
4' Exoperidium with flesh layer not forming a collar-like
structure, spore ornamentation verrucose .... *G. smardae*

Descriptions of the species

Geastrum pectinatum Pers.: Pers., Syn. Meth. Fung.: 132, 1801.
Fig. 1

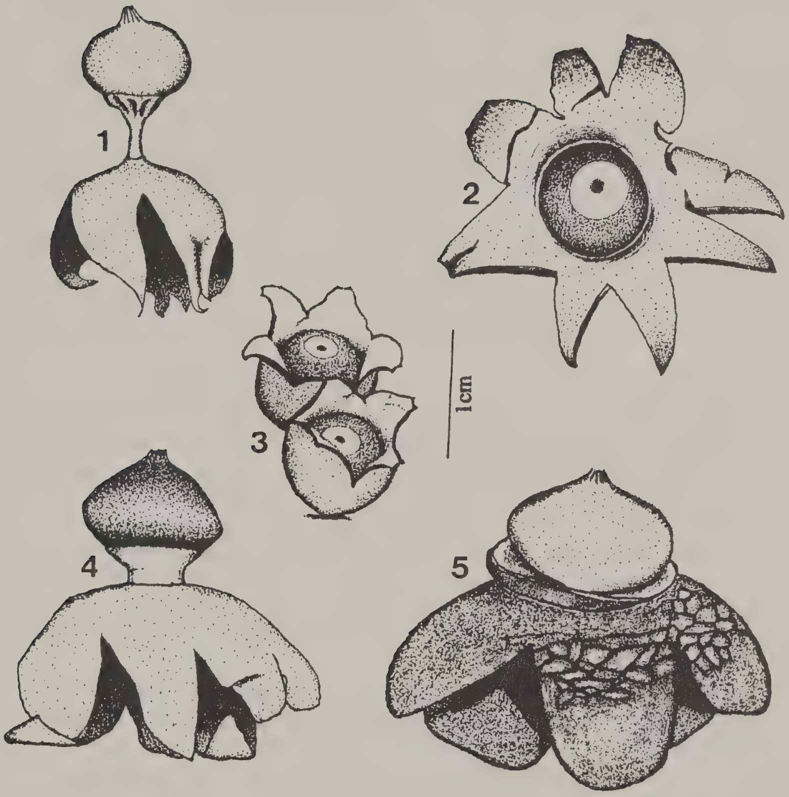
Unexpanded basidiomata subglobose, hypogeous when immature becoming epigeous when mature, 1–1·5 cm diam., 2–3 cm across when expanded; exoperidium non-hygroscopic, revolute, vaulted, rigid, splitting to about the middle into 7–9 rays, mycelial layer brownish orange (KW 5C3), adnate, covered with adhering debris, hyphae 2–3 μm diam.; fibrous layer well definite, hyphae 3–4 μm diam.; fleshy layer usually adnate, hyphae 20–30 × 15–20 μm; endoperidium pedicelate, pedicels slender, 3–4 mm long, subglobose, 7–10 mm wide, with sulcate apophysis, greyish-brown (KW 5F3), hyphae 4–5 μm diam., peristome concolourous, mouth sulcate, slender and conical; gleba dark brown (KW 5F5), columella inevident; capillitium light brown, unbranched, 4-6 μm diam.; basidiospores spherical, 4–4·5 μm diam.

Material examined: Brazil, São Paulo: Ecological Station of Itirapina, 19/II/1999, coll., det. Baseia (SP 307528), cerrado vegetation; Biological Reserve of Moji-Guaçu, 16/III/1999, coll. & det. Baseia (SP 307529), cerrado vegetation; Pernambuco: Biological Reserve of Serra Negra, 19/IV/2002, coll. & det. Baseia (URM 398900), caatinga vegetation.

Additional material examined: Germany, Berlin: det. B. Hennig, 1932, (PACA 15989); Brazil, Rio Grande do Sul, Pareci: 1918, det. J. Rick (ICN 3495; SP 33981); São Paulo, São Paulo, Cumbica: 1983, det. P. G. Kupper (SP 178065); Paraíba, João Pessoa, Botanical Garden: 01/ VI/1997, coll. & det. Baseia (JPB 22874, URM 75812).

Habitat: Solitary or in groups on sandy soil.

Distribution: United States of America (Lloyd 1902, Coker & Couch 1928, Long & Stouffer 1948), France and Sweden (Lloyd 1902), Australia (Cunningham 1944), South Africa (Bottomley 1948), Norway (Eckblad 1955), Mexico (Herrera 1957), England (Palmer 1959), Brazil (Rick 1930, 1961), Congo (Dissing & Lange 1962), Belgium



Figures 1-5. General aspect of mature basidiomata: 1. *Geastrum pectinatum*; 2. *G. saccatum*; 3. *G. schweinitzii*; 4. *G. smardae*; 5. *G. triplex*

(Demoulin 1968), Hawaii (Smith & Ponce de Leon 1982), China (Liu 1984), Aland Islands (Haeggström 1997), Spain (Calonge 1998), Argentine (Soto & Wright 2000).
Remarks: *Geastrum pectinatum* presents several morphological variations that probably have been taken for different species by some authors. This species is very close to *G. schmidelii* Vittad. and *G. striatum* DC., differing mainly by the pedicelate endoperidium with a basal apophysis and by the strongly sulcate, slender and conical peristome.

Geastrum saccatum Fr., Syst. Mycol. 3: 16, 1829.
Fig. 2
Unexpanded basidiomata ovate, epigeous, 1–2 cm diam., 3–4 cm across when expanded; exoperidium non-hygroscopic, saccate, non-rigid, splitting to about the middle into 6–8 rays, mycelial layer yellowish white (KW 4A2), smooth, hyphae 2–4 µm diam.; fibrous layer well definite, hyphae 3–6 µm diam.; fleshy layer usually adnate, hyphae 25–30 × 20–25 µm; endoperidium sessile, subglobose, 10–20 mm wide, light grey (KW 1D1), hyphae 3–4 µm diam.; peristome white (KW 1A1), limited by a groove, mouth fibrillose; gleba medium grey (KW 1E1), columella indistinct; capillitium hyaline, unbranched or shortly branched, 3–4 µm diam.; basidiospores spherical, 3–4 µm diam.
Material examined: Brazil, São Paulo, Ecological Station of Itirapina, 19/II/1999, coll. & det. Baseia (SP 307533), gallery forest; 17/IV/2000 (SP 307535); Biological Reserve of Moji-Guaçu, 26/II/1999, coll. & det. Baseia (SP 307534), gallery forest; Pernambuco, Gurjaú Complex, 29/VI/2002, coll. & det. Baseia (URM 390452), Atlantic rain forest.
Additional material examined: United States of America, Maryland, Great Falls, 02/X/1969, det. D. M. Dring (SP 50631); Brazil, Rio Grande do Sul, Pareci, J. Rick, 1932 (PACA 15951); São Leopoldo, 1932, det. J. Rick (PACA 15975); Santa Maria, 1936, det. J. Rick (PACA 15982); São Salvador, 1944, det. J. Rick (PACA 22609); São Paulo, Itirapina, 01/III/1969, det. D. M. Dring (SP 141677); Moji-Guaçu, 1969, det. C. T. Rogerson (SP 112649); Paraíba, João Pessoa, Botanical Garden, 12/ III/ 1997, coll. & det. Baseia (JPB 22888, URM 75813).
Habitat: Solitary on the litter.
Distribution: United States of America (Lloyd 1902), Brazil (Sydow & Sydow 1907, Rick 1961, Bononi *et al.* 1984, Kimbrough *et al.* 1995), Cuba (Ponce de León 1946), South Africa (Bottomley 1948), Panama (Garner 1956), Congo (Dissing & Lange 1962), West Africa (Dring 1964), Mexico (Dubovoy *et al.* 1966, Guzmán-Dávalos & Guzmán 1979, Esqueda-Valle *et al.* 1990, Pardavé 1991), Tobago (Reid 1976), Hawaii (Smith & Ponce de Leon 1982), China (Liu 1984), Tanzania (Calonge *et al.* 1997), Argentine (Soto & Wright 2000).
Remarks: *Geastrum saccatum* is fundamentally characterized by the fibrillose mouth surrounded by a whitish peristome limited by a groove, a saccate exoperidium and a sessile endoperidium.

Geastrum schweinitzii (Berk. & M.A. Curtis) Zeller, Mycotaxon 40: 649, 1948.
Basionym: *Coilomyces schweinitzii* Berk. & M.A. Curtis, Jour. Acad. Nat. Sci. Phil. 2(2): 297, 1853.
Fig. 3
Unexpanded basidiomata subglobose, caespitose, epigeous, 0·7–1 cm diam., expanded at maturity to 1·5–2 cm across, base characteristically attached to a thick subiculum, yellowish white (KW 2A2); exoperidium non-hygroscopic, saccate, split to about the

middle into 5–8 rays, mycelial layer yellowish white (KW 2A2), smooth, hyphae 3–5 µm diam.; fibrous layer inevident; fleshy layer adnate, hyphae 22–33 × 15–28 µm; endoperidium sessile, 5–8 mm wide, grey (KW 2E1), glabrous, hyphae 3–5 µm diam.; peristome whitish, mouth fibrillose; gleba olive grey (KW 2F2), columella inevident, capillitium light brown, unbranched or shortly branched, 4–4·5 µm diam.; basidiospores spherical, 3–3·5 µm diam.

Material examined: Brazil, São Paulo, Ecological Station of Jataí, 17/II/1999, coll. & det. Baseia (SP 307536), gallery forest; 18/III/1999, coll. & det. Baseia (SP 307538), gallery forest; 22/IV/2000, coll. & det. Baseia (SP 307540), gallery forest; Ecological Station of Itirapina, 18/II/1999, coll. & det. Baseia (SP 307539), gallery forest; Biological Reserve of Moji-Guaçu, 20/II/1999, coll. & det. Baseia (SP 307537), gallery forest; Pernambuco: Gurjaú Complex, 29/VI/2002, coll. & det. Baseia (URM 77076), Atlantic rain forest.

Additional material examined: Brazil, Rio Grande do Sul, São Leopoldo, 1932, det. J. Rick (PACA 15974); São Paulo, Ipiranga, 1921, det. J. Rick (ICN 3495); Alagoas, Maceió: 01/XII/1992, det. V. L. Bononi (SP 250609); Paraíba, João Pessoa, Botanical Garden: 19/ V/ 1996, coll. & det. Baseia (JPB 22918, URM 75818).

Habitat: Caespitose on decaying wood.

Distribution: Brazil (Rick 1910, 1930, 1961, Bononi *et al.* 1981, Kimbrough *et al.* 1995), Australia (Cunningham 1944), Cuba (Ponce de Leon 1946), South Africa (Bottomley 1948), Panama (Garner 1956), Congo (Dissing & Lange 1962), West Africa (Dring 1964), Mexico (Pérez-Silva 1974) and China (Liu 1984)

Remarks: *Geastrum schweinitzii* is easily recognized by its small size, caespitose basidiomata with the base characteristically attached on an abundant whitish subiculum. According to Ponce de Leon (1968), there is no doubt that *Coilomyces schweinitzii* and *Geastrum mirabile* Mont. are the same species.

Geastrum smardae V.J. Staněk, Česká Mykol. 10: 22, 1956.

Fig. 4

Unexpanded basidiomata subglobose, hypogeous when immature, becoming epigeous, 1–2 cm diam., expanded at maturity to 2·5–3 cm across; exoperidium revolute, splitting to about the middle into 6–8 rays, mycelial layer orange grey (KW 5B2), adnate, covered with adhering debris, hyphae 2–4 µm diam.; fibrous layer thin, hyphae homogeneous, 2–3 µm diam.; fleshy layer usually adnate, hyphae 15–35 × 10–30 µm; endoperidium sessile, dark blond (KW 5D4), hyphae 3–4 µm diam.; peristome concolourous and conical, mouth fibrillose; gleba yellowish brown (KW 5E4), columella present; capillitium light brown, unbranched or shortly branched, 3–4 µm diam.; basidiospores spherical, 4–4·5 µm diam.

Material examined: Brazil, São Paulo, Ecological Station of Jataí, 17/II/1999, coll. & det. Baseia (SP 307541), gallery forest.

Additional material examined: Brazil, São Paulo, Monte Alegre, 05/V/1969, det. D. M. Dring (SP 50560).

Habitat: Solitary on the litter.

Distribution: United States of America as *Geaster limbatus* Fr. (Coker & Couch 1928, Long & Stouffer 1948).

Remarks: *Geastrum smardae* is characterized fundamentally by the dark basidiomata with a fornicate exoperidium and a pedicellate endoperidium with the fimbriate mouth.

Some specimens sometimes resemble *G. triplex*. However, it can be segregated basically by the basidiospores size and ornamentation.

Geastrum triplex Jungh., Tijdschr. Nat. Gesch. Physiol. 7: 287, 1840.
Fig. 5

Unexpanded basidiomata depressed globose, epigeous, 2–3 cm diam., 4–7 cm across when expanded; exoperidium revolute, non-hygroscopic, splitting to about half way or more into 6–8 rays, mycelial layer light brown (KW 5D4), glabrous, hyphae 3–5 µm diam.; fibrous layer well definite, hyphae 2–5 µm diam.; fleshy layer yellowish-brown (KW 5E5), usually becoming cracked with a portion persisting as a collar around the base of the endoperidium, hyphae 18–37 × 10–25 µm; endoperidium sessile, depressed or subglobose, yellowish-brown (KW 5F5), hyphae 3–5 µm diam.; peristome concolourous and conical, usually outlined by an upraised margin, mouth fibrillose; gleba yellowish-brown (KW 5E5), columella distinct, capillitium brown, 3–5 µm diam., unbranched, incrusted with debris; basidiospores spherical, 4–5 µm diam.

Material examined: Brazil, São Paulo, Ecological Reserve of Itirapina, 19/III/1999, Baseia (SP 307542), gallery forest; 18/IV/2000, coll. & det. Baseia (SP 307543).

Additional material examined: England, 24/X/1966, det. D. N. Pegler (SP 107405); Brazil, Rio Grande do Sul, São Leopoldo: 1931, det. J. Rick (PACA 15983).

Habitat: Solitary on the litter.

Distribution: United States of America and Canada (Lloyd 1902, Coker & Couch 1928), Argentine (Spegazzini 1927, Soto & Wright 2000), South Africa (Bottomley 1948), Panama (Garner 1956), Congo (Dissing & Lange 1962), Mexico (Dubovoy *et al.* 1966, Guzmán-Dávalos & Guzmán 1979, Pardavé 1991), Belgique (Demoulin 1968), Canary Islands (Eckblad 1975), Tobago (Reid 1976), Hawaii (Smith & Ponce de Leon 1982), China (Liu 1984), France (Moyersoen & Demoulin 1996), Canary Islands (Tejera *et al.* 1998).

Remarks: Ponce de Leon (1968), Smith & Ponce de Leon (1982) and other authors have regarded *Geastrum indicum* (Klotzsch) R. Rauschert as the correct name for *G. triplex*. However, others like Sunhede (1977, 1989), Dörfelt & Müller-Uri (1984) and Dörfelt & Heklau (1987) argue that *G. indicum* should be rejected as a *nomen dubium* and that *G. triplex* should be maintained as the correct name for this species, as also assumed by Mornand (1993). The character used by Junghuhn in 1840 to segregate this species was the collar-like form of the inner layer of the exoperidium.

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HALOPHYTOPHTHORA ELONGATA, A NEW MARINE SPECIES FROM TAIWAN

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ABSTRACT

Halophytophthora elongata, a new marine species, was isolated from fallen, yellow and submerged leaves of mangrove (*Avicinnia marina)* at Shih-tsao, Tainan County, Taiwan. It is distinguished from other species of *Halophytophthora* primarily by (a) the variable but often exceptionally long sporangia, (b) the production of a solid dehiscence plug which is ejected and becomes evanescent and (c) the formation of a persistent, tubular vesicle through which zoospores are released.

Keywords: Pythiaceae, oomycete, straminiopilous fungus, mangrove, *Avicinnia*

In the course of a survey of oomycetes on fallen, yellow leaves of mangrove, *Avicininia marina* (Forsk) Vierh., a pythiaceous fungus was isolated from Shih-tsao, Tainan in February, 2001. It has unique morphological characteristics that distinguish it from other known species of *Halophytophthora* Ho and Jong and is herein described as a new species.

Halophytophthora elongata H. H. Ho & H S. Chang **sp. nov.** Figs. 1- 13

Mycelium appressum submersum. Hyphae hyalinae laevitunicatae subirregulares, 3-9 um latae, eseptatae vel aetate regulariter septatae, libere ramificantes vel floccosae, ramulis brevibus fortibus praeditae. Intumescentiae hyphales interdum praesentes clavatae vel ovoideae, maximam partem intercalares, 9-18 um diametro. Sporangiophora haud distincta, simplicia, 3-5 um lata, vulgo 12-800 um longa. Zoosporangia unica terminalia hyalina vel subhyalina non decidua papillata ovoidea obclavata, bursiformia, cylindracea vel maxime elongata, 115-530 x 32-64 um, septo basali subsporangiali atque epistomio basali 12-32 x 6-8 um praedita. Tubus dehiscentiae cylindraceus 12-32 x 6-8 um, in apice materia hyalina epistomiali farctus; apex maturitate rumpens deinde recurvus, collare formans, epistomium dehiscentiae solidum 10 x 5.6 um aperiens. Sub germinatione epistomium e poro exitus 6-8 um lato depulsum deinde evanescens. Zoosporae ovoideae vel reniformes biflagellatae, intra zoosporangium formantes dein e vesicula persistenti (80-)150-180 (-215) x 15-25 um liberatae. Zoospora encystata 7-14 um diametro, ex tubo germinali unico germinans. Fabricae sexuales atque chlamydosporae non visae.

Habitat in foliis caducis Avicinniae marinae (Forsk.) Vierh.

TYPE. TAIWAN, TAINAN, SHIH-TSAO. Dried culture from fallen, yellow leaves of *Avicinnia marina* (Forsk.) Vierh. Submerged in seawater. 17 II 2001. Y.M. Ju, Institute of Botany, Academic Sinica, Taipei, Taiwan. Ex-type culture deposited with ATCC .

Halophytophthora elongata was isolated by Tokumasu's method (1978). Hyphal tips growing out from leaf discs were transferred to *Phytophthora* selective medium (cornmeal agar supplemented with 200 ppm ampicillin, 50 ppm mycostatin and 10 ppm pentachloronitrobenzene). Long, club-shaped zoosporangia were picked singly , subcultured onto selective agar medium again to establish mycelial growth before it was transferred to10% clarified V-8 juice agar (Ho et al. 1995) with distilled water replaced with 20% seawater (SV8). It grew best at 28° C forming an appressed, submerged and distinctively rosette colony with a daily growth rate of 5 mm.The hyphae were hyaline, smooth-walled, slightly irregular, 3-9 µm wide, nonseptate or regularly septate with age, branched freely or tufted with short, stout branches. Hyphal swellings present, clavate to ovoid, mostly intercalalry, 9-18 um diam. The minimal and maximal temperatures for growth were 10 and 38° C, respectively. Zooporangia were not observed on SV8 agar plates but were profusely produced by the following method. From the edge of an actively growing fungal colony on SV8 agar plate a mycelial agar block (0.2-0.3 mm square) was removed and placed in the center of a sterile 6 cm plastic petri dish, followed by the addition of sterile SV8 liquid (20% clarified V8 juice, 20% seawater and 60% distilled water) so that the mycelial disc was just submerged. After 2-day growth at room temperature (24-25° C) when the mycelial mat reached 2-3 cm diam, the SV8 liquid was removed, replaced first with distilled water to rinse the mycelial disc and then followed by the addition of the sporangial inducing solution (20% nonsterile seawater, 80% soil extract prepared by mixing 10gm field soil with 500 ml tap water and filtered with filter paper and then through a 0.22 µm millipore filter unit). After 1-2 day at room temperature, abundant zoosporangia and zoospores were produced in water. They were observed under a dissecting microscope and the mycelia with zoosporangia were mounted on glass slides to be studied and photographed under a compound microscope using interference contrast microscopy.

The sporangiophores are undifferentiated, unbranched, 3-5 µm and mostly 12-800 µm long, sometimes reaching 2 mm long.The zoosporangia are single, terminal, hyaline to subhyaline, nondeciduous, variable in shape and size (Figs. 1-9), ranging from obovoid, obclavate, bursiform, cylindrical to exceptionally elongated, 115-530 x 32-64 µm with a subsporangial basal septum and a basal plug 12-32 x 6-8 µm. Occasionally, intercalary, bipapillate or subterminal sporangium with a short hyphal appendage can be found. As the sporangium matures a hyaline plug material appears at the rounded apex of the dehiscence tube (Figs. 5, 6, 9). Later, the wall of the apex ruptures and curls back to form a collar, thus exposing a solid dehiscence plug , 10 x 5.6 µm with a convex distal and a concave proximal ends (Figs. 3, 7, 8). In sporangial germination, the plug is suddenly and forcefully expelled into the water (Figs. 10, 12), followed immediately by a rapidly elongating tubular vesicle, (80-) 150-180 (-215) x 14-25 µm (Figs. 11-13). Zoospores are formed within the sporangium proper and released through the vesicle . The released plug floats away and disintegrates rapidly whereas the vesicle is persistent, attached to the exit pore

(6-8 µm wide) of the dehiscence tube (Figs. 12, 13). When the sporangia were mounted on a glass slide, the vesicles might break away completely from the exit pore or only the lower portion was retained. It was difficult to determine exactly how the vesicle was formed because both the expulsion of the plug and the extension of the vesicle appeared suddenly and rapidly. Presumably, the extruded plug was derived from the central part of the distal portion of the plug material within the dehiscence tube whereas the rest of the plug material was rapidly transformed into the vesicle which extended suddenly, pushing out the plug and allowing the zoospores to be released.

Compared with the 14 species and 2 varieties of *Halophytophthora* in the most recent key of Nakagiri et al. (2001) *H. elongata* would fall out at the level of *H. masteri* Nakagiri, Newell and Ito. Unlike other similar *Halophytophthora* species which produce smooth-walled sporangia with dehiscence tubes, both *H. elongata* and *H. masteri* are unique in the formation of firstly an extruded solid dehiscence plug and then a tubular vesicle prior to zoospore release from a zoosporangium. The zoosporangia of *H. exoprolifera* Ho, Nakagiri and Newell, *H. bahamensis* (Fell & Master) H.H. Ho & S.C. Jong, *H. epistomium* (Fell & Mater) H. H. Ho & S. C. Jong and *H. tartarea* Nakagiri and Newell produce only dehiscence plugs but no vesicles. On the other hand, no solid dehiscence plugs are formed by the sporaniga in *H. vesicula* (Anastasiou & Churchl.) H.H. Ho & S.C. Jong, *H. batemanenesis* (Gerr.-Corn. & Simpson) H.H. Ho & S.C. Jong and *H. polymorphica* (Gerr.-Corn. & Simpson) H.H. Ho & S.C. Jong even though vesicles are present. In *H. porrigovesica* Nakagiri, Ito, Manoch and Tanticharoen the sporangium is epapillate instead of papillate, and although a vesicle is formed, only a lens-shaped dehiscence plug-like material is produced at the sporangial apex and it becomes liquescent, vanishing at ejection. *Halophytophthora elongata* closely resembles *H. masteri* from which it can be differentiated based primarily on the evanescnce of the extruded plug in water and the persistent vesicle attached to the exit pore. In *H. masteri* the extruded plug becomes elongated in water, persisting longer than 3 hr whereas the vesicle usually shrinks and is retracted completely into the zoosporangium, 7-10 min after zoospore release (Nakagiri et al. 1994). Furthermore, the sporangia of *H. elongata* are more variable and the cylindrical ones are more elongated.

ACKNOWLEDGMENT

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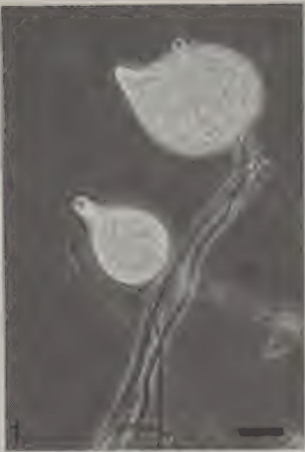
Fig. 1-13. *Halophytophthora elongata* sporangia. Arrows indicate the hyaline plug material (5,6,9), dehiscence plug (3,7,8), expelled plug in water (10,12), persistent tubular vesicle (11,13) attached to the exit pore. Scale bar in all figures = 60µm except (12) where scale bar = 20µm.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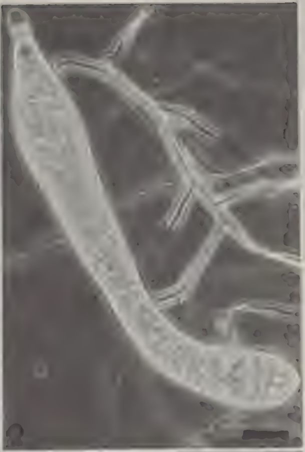
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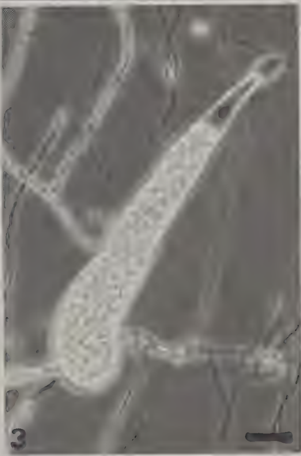
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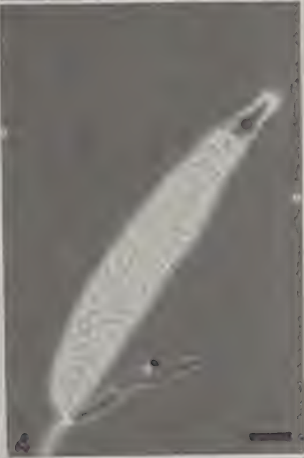
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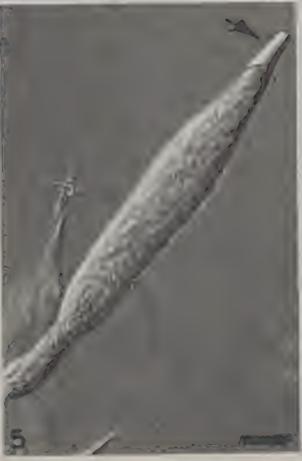
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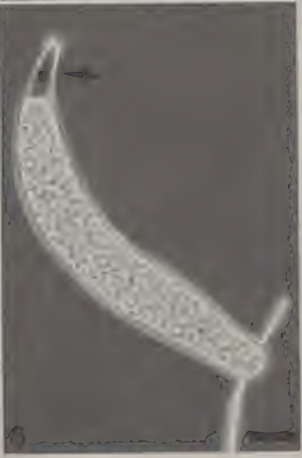
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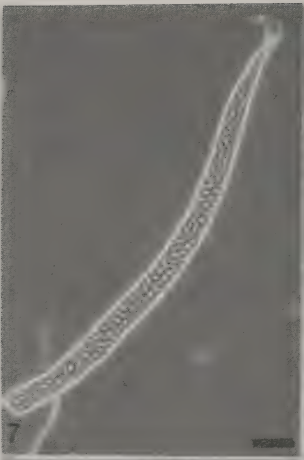
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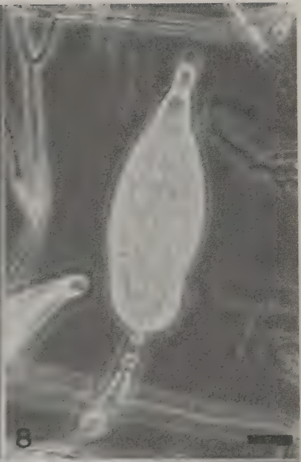
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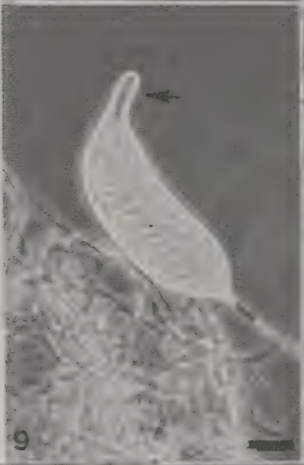
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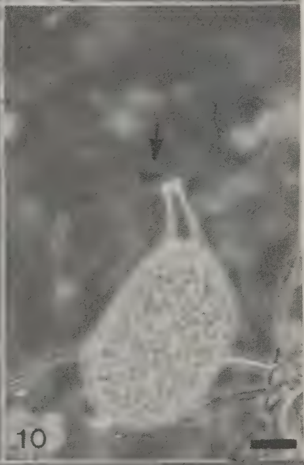
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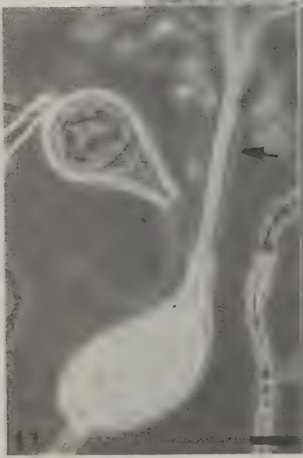
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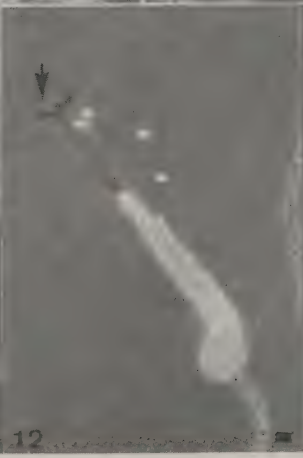
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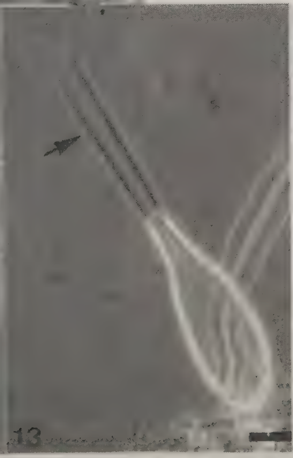
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MYCOTAXON

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A CHECKLIST OF MANGROVE-ASSOCIATED FUNGI, THEIR GEOGRAPHICAL DISTRIBUTION AND KNOWN HOST PLANTS

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ABSTRACT

We present a checklist of fungi that have been reported in the literature to be associated with mangrove forests. In total 625 fungi are listed, including 278 ascomycetes, 277 mitosporic fungi, 30 basidiomycetes and 14 oomycetes. For each fungus we list their known geographic distribution in mangrove forests, host associations, as well as known habitats and type of substrate. Ascomycetes and mitosporic mangrove-associated fungi differ in their substrate affinities and habitats. Terrestrial and sediment fungi have more restricted geographical distributions compared to intertidal fungi, but this may be due to sampling error rather than biological reality.

KEYWORDS: Marine fungi, Host preference, Mangrove fungi, Marine ecology

INTRODUCTION

While fungi have been reported from mangrove forests since at least the 1920's (Stevens, 1920), the study of mangrove inhabiting fungi began in earnest with the work of Cribb and Cribb in the 1950's in Australia (Cribb and Cribb 1955,1956). Since that time, interest in mangrove fungi has increased dramatically, and studies of the mangrove mycota have taken place worldwide.

As knowledge of and interest in mangrove inhabiting fungi increase, there has been a corresponding need to summarize information about these fungi. Several papers have been written which summarize this information. Kohlmeyer (1969) provided a list of the 39 ascomycetes, 27 mitosporic fungi, 9 basidiomycetes, and 1 myxomycete species that were known from mangroves at that time, as well as information about their host preferences. He showed that there are distinct marine and terrestrial mangrove mycotas, although the two groups overlap at the high tide zone. According to Kohlmeyer, fungal species appear to respond to the salinity of the water, with different species being common at different salinities. He speculated that several species of fungi are host specific, although since that time all of the species he discussed have been found on additional hosts.

Hyde and Jones (1988) listed 90 species of intertidal mangrove fungi which had been collected from 26 different tree species. They demonstrated that most of the intertidal mangrove fungi found on wood are widespread species occurring in more than one ocean basin.

Jones and Alias (1997) estimated that there were 200 ascomycetes, 63 mitosporic fungi and 5 basidiomycetes known from the marine portion of mangroves (including species awaiting description). They pointed out that there is little evidence for strict host specificity in mangrove fungi as almost all species that have been found repeatedly occur on multiple hosts. However, there is evidence for host preference – some fungi are more common on certain hosts than others. Thus, although mangrove fungi are not narrowly host specific, the hosts present in a mangrove forest can play a role in shaping the fungal community found there. They agree with Hyde and Lee (1995) that marine fungal species richness may be greater in the Asian tropics due to a higher host diversity, but this is somewhat confounded by the fact that more effort has been put into studying Asian tropical marine fungi than marine fungi from other areas.

Here we present an updated checklist of mangrove-associated fungi. This checklist is a compilation of the known geographic and host distribution of these fungi as well as information about the substrate type and habitat.

MATERIALS AND METHODS

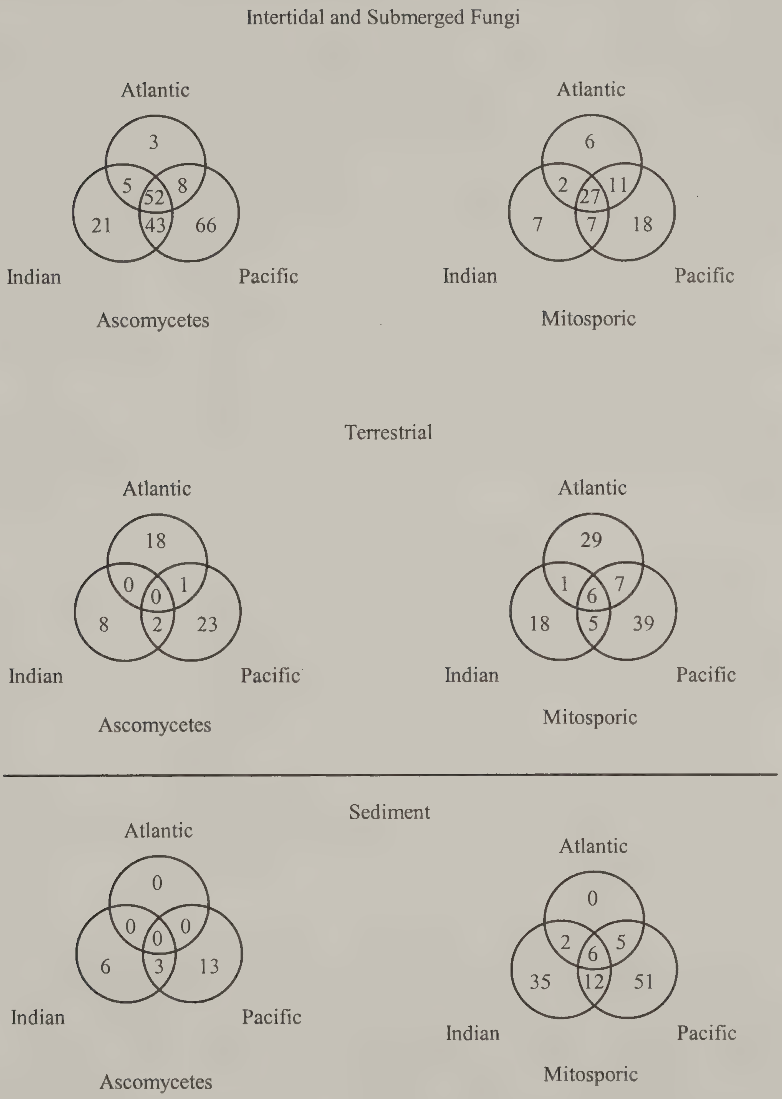
We performed an extensive review of the literature on mangrove inhabiting fungi. In total, we extracted information from more than 250 sources. We attempted to review every publication on mangrove fungi published before 2000, however some papers were not available to us, and others likely were missed. Some papers published after 2000 were also included in the review.

In preparing this checklist, we had to decide which fungi would be included. Kohlmeyer (1969) defined a mangrove fungus as one that can grow and reproduce in the mangrove environment. In his opinion, fungi which have only been isolated from mangrove substrates in a laboratory setting (using particle plates or a similar means) have not been proven to grow or reproduce in the mangrove environment. While Kohlmeyer made an important point, the literature does not allow us to make an accurate determination of the activity of many of the fungi reported from mangrove substrates. In order to be as inclusive as possible, our definition of mangrove inhabiting fungi is any fungus which has been reported from mangrove swamps or which has been isolated from mangrove materials. Many of the fungi reported from mangroves also occur in other habitats; these fungi are included in our checklist.

We collected the following information, when available for each fungal species: geographic distribution, host species, substrate type (dead wood, living leaves, sediment etc.) and habitat. Four different habitats were recognized: 1) intertidal – fungi which frequently experience both dry and wet conditions; 2) submerged – fungi which are constantly immersed in sea water; 3) terrestrial – fungi which are found above the high tide zone; 4) sediment – fungi which are found in mangrove sediment including peat, presumably saprophytic on fine roots and other plant material. We also list synonyms for many of the species, using both the mangrove literature and the funindex website (CABI Bioscience, 2002). The lists of synonyms are not meant to be exhaustive, nor does the choice of one synonym over another indicate a taxonomic opinion on the part of the authors. The synonyms are presented solely as an aid in reading the mangrove literature.

RESULTS

The complete list of mangrove-associated fungi and related information is presented in Appendix 1. In total, 279 ascomycetes, 277 mitosporic fungi, 29 basidiomycetes, 3 chytridomycetes, 2 myxomycetes, 14 oomycetes, 9 thraustochytrids and 12 zygomycetes have been reported from mangrove forests. This information can also be found on the world wide web at http://fm5web.life.uiuc.edu:23523/mangrove/.


Intertidal and Submerged Fungi
Atlantic
3
5
8
52
21
43
66
Indian
Pacific
Ascomycetes
Atlantic
6
2
11
27
7
7
18
Indian
Pacific
Mitosporic
Terrestrial
Atlantic
18
0
1
0
8
2
23
Indian
Pacific
Ascomycetes
Atlantic
29
1
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Mitosporic
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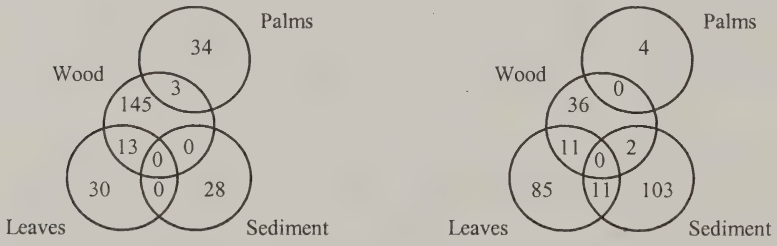
0
0
0
6
3
13
Indian
Pacific
Ascomycetes
Atlantic
0
2
5
6
35
12
51
Indian
Pacific
Mitosporic

Fig. 1. Distribution of mangrove-associated ascomycete and mitosporic species by ocean basin. Numbers within each circle represent the species found only in that basin. Numbers in the Indian Ocean basin include fungi listed as Middle Eastern in Appendix 1. Numbers in the overlapping sections represent the number of species shared between those basins.

The geographic distribution of a mangrove-associated fungus is clearly influenced by its habitat within the mangrove. Ascomycetes and mitosporic fungi which are found in the intertidal zone or completely submerged in water tend to have a wide geographic distribution (Fig. 1). Basidiomycetes which are in the intertidal zone also follow this pattern, but many intertidal oomycetes have a more restricted distribution. The distributions of fungi in other classes are not summarized due to the low number of records of mangrove-associated species in those groups. More intertidal and submerged fungi have been found in multiple ocean basins than have been found in only one ocean basin, although a large number of fungi are known only from the Pacific basin. This is a striking contrast to the mangrove-associated fungi found either in terrestrial parts of the mangrove, or those which are in the sediment.

Terrestrial and sediment inhabiting fungi are usually restricted to a single ocean basin, and often have been found only at a single locality (Appendix 1). Like the intertidal and submerged fungi, more terrestrial and sediment species have been found in the Pacific Ocean basin.

Species in different classes of mangrove fungi also differ in their distribution patterns, both within the mangrove and at the global scale. The majority of ascomycetes are intertidal or submerged species. Consequently, most of the ascomycetes are widely distributed. Mitosporic species (which are usually the mitosporic forms of the ascomycetes, but could be basidiomycetes) are more likely to be terrestrial or sedimentary species, and therefore tend to be restricted to a single ocean basin. Most of the basidiomycetes are terrestrial wood decay species, and these usually have restricted distributions. Oomycetes are almost entirely intertidal leaf decay species. Some oomycetes have a global distribution, but most are found in only a single ocean basin.



Ascomycetes

Mitosporic Fungi

Fig. 2. Distribution of mangrove associated ascomycetes and mitosporic species by substrate type. Numbers within each circle indicate the number of fungal species found on that substrate type. Numbers in the overlapping regions indicate the number of species found on multiple substrate types. "Palms" refers to fungi found on the mangrove palm, *Nypa fruticans.*

Most mangrove-associated fungi are often found on only a single type of substrate (Fig. 2). More mangrove-associated fungi are known from wood than any other substrate type. Mitosporic fungi are most commonly found on leaves or in sediment samples, whereas ascomycetes are more commonly found on wood. The mangrove palm, *Nypa fruticans* has a number of unique fungal species on it, primarily ascomycetes (Hyde and Alias, 2000). Of the fungi which are found on leaves, only six are listed as endophytes in Appendix I. Many more endophytic species remain to be discovered (Suryanarayanan and Kumaresan, 2000).

DISCUSSION

The list presented in Appendix 1 is considerably longer than previous lists of mangrove-associated fungi. This is partially due to the broad criteria which were used in assembling the list. Previous lists have often focused on species from particular locations, a particular host, or of a particular taxonomic group. However, many of the species on this list are newly described or reported since previous compilations. Likely many new mangrove-associated fungi remain to be found.

It is difficult to judge how much the differences in fungal distribution (Figs. 1 & 2) are due to biology and how much is due to sampling bias. Ascomycetes found in the intertidal and submerged parts of the mangrove are undoubtedly the best known fungi, and their wide geographic distribution is clearly not an artifact.

There are several possible reasons why a large number of intertidal and submerged fungi are found only in the Pacific basin, particularly as compared to the Atlantic basin. The Pacific Ocean is home to a high diversity of mangrove hosts (Chapman, 1976; Tomlinson, 1986), and this may in turn contribute to a high diversity of fungi. On the other hand, the Pacific Ocean has been more extensively and more recently surveyed than the other basins, so sampling bias cannot be ruled out.

Geographic patterns in terrestrial and sediment fungi are probably largely due to sampling bias. The geographic pattern for fungi in sediments is based on a few studies which have attempted to document fungi from the sediment at a particular location. None of these studies have taken place in an Atlantic Ocean site. Terrestrial fungi, on the other hand, are generally not the subjects of surveys. Rather, these fungi have been individually described from a wide variety of locations, and many of them have been reported only once. For both of these groups, the small number of species known combined with haphazard collection sites make it impossible to determine much about their geographic distributions.

Despite the sampling bias, the differences in habitat preference between ascomycetes and mitosporic fungi are most likely real. Numerous studies have investigated fungi on intertidal wood, and they consistently demonstrate that ascomycetes are the dominant fungi on that substrate. Similarly, studies of fungi in the sediment at widely separated localities regularly find a preponderance of mitosporic fungi, a result which is not due to sampling error.

Finally, the differences in substrate affinities between ascomycetes, mitosporic fungi, basidiomycetes and oomycetes are well documented. It has been noted that intertidal ascomycetes often have appendages or gelatinous sheaths which help them to fasten on to wood in the intertidal zone (Rees and Jones, 1984; Jones, 1985). Mitosporic fungi are largely lacking these appendages. This may explain why they are much less common in the intertidal zone and are more common in the sediment, where such appendages would not be needed for spores to attach to the substrate. Basidiomycetes are very rare in aquatic and marine environments in general, which explains their restriction to wood above high tide. In terrestrial environments, basidiomycetes also play an important role in leaf decay. In the mangrove environment, however, almost all dead leaves and wood falls to the forest floor and come into contact with salt water, which hampers the growth of most basidiomycetes. Marine oomycetes, on the other hand, seem to be present on almost all dead intertidal mangrove leaves, at least in the early stages of decay (Newell, et al 1987).

AREAS FOR FUTURE STUDY

Hundreds of plant species live in the mangrove habitat, Tomlinson (1986) lists 116 woody mangrove species alone. However, fungi have been reported from only 72 of them. Even of that number, very few plants and few plant parts have been examined in detail at multiple sites. For those hosts which have been studied, often only a single plant part has been examined. Wood has been studied more than leaves, so further studies of leaves would greatly expand our knowledge. Very few studies have examined the fungi found in sediment/soils in mangroves, and at this point our knowledge is fragmentary at best.

Mangrove forests in many parts of the world have yet to be surveyed for fungi. Foremost among these areas is Africa. Although there are some studies reported from West Africa (Kohlmeyer, 1968; Aleem, 1980) and the Indian Ocean Coast of South Africa (Gorter 1978; Steinke and Jones, 1993), most of the continent, as well as Madagascar, remains unexamined. New world mangrove forests have been surveyed frequently for fungi (e.g. Kohlmeyer and Kohlmeyer, 1971; Hyde 1992; Kohlmeyer and Volkmann-Kohlmeyer, 1987;Kohlmeyer and Volkmann-Kohlmeyer 1988; Kohlmeyer et al 1995), but many areas remain unexplored. In particular, little is known about South America, Central America south of Belize and the Gulf Coast of the United States. Mangrove forests of Austral-asia, particularly the Pacific Coast have received the most attention from mycologists (e.g. Vrijmoed 1990, Hyde, 1988; Leong et al, 1988; Tan and Leong, 1990; Vrijmoed et al 1994; Alias et al 1995). However, mangrove forests of Burma and Thailand, and much of China still need to be studied. Finally, more fungal surveys need to be conducted in temperate mangroves throughout the world.

Before we can get a complete picture of the distribution of mangrove-associated fungi, we need to uncover the relationships between the mitosporic fungi and their sexual states, if present. While some progress has been made in this regard (e.g. Nakagiri and Tubaki, 1985) most mitosporic mangrove-associated fungi have not been associated with a sexual state. Presumably the geographic ranges of the sexual and mitosporic states of individual fungal species are largely overlapping. However, it is also clear that the different sexual states are decomposing different substrates in the mangrove environment. Understanding the relationship between the ecological roles of mitosporic fungi and their sexual states remains a major challenge for fungal ecology.

Finally, it is not enough to just document the geographic and host distribution patterns we see in nature; we must also seek to explain them. While some initial work has been done with introduced mangroves (Volkmann-Kohlmeyer and Kohlmeyer, 1993), at this point in time we do not know what combination of historical, evolutionary and ecological events led to the distributions we see today. Only combining data from a wide variety of studies, including both laboratory and field experiments, will allow us to understand the distribution patterns of mangrove-associated fungi.

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Species	Habitat	Substrate	Host Species	Distribution	References
Ascomycetes					
Acanthostigma conocarpi Tracy & Earl	T	Dead leaves	CE	**Atl**:F	193
Achaetomium macrosporum J.N.Rai & H.J. Chowdhery	D	Sediment		**Pac**:O	103,104
Acrocordiopsis patilii Borse & K.D. Hyde	I	Dead wood	AA,AM,AO,RA,RU, SA,SG,XG	**Ind**:AI,ESA,Md,Mr,MINI **Pac**:Br,Q,T	8,21,26,27,55,56,83,84,110, 145,194,206
Acrocordiopsis sphaerica Alias & E.B.G. Jones	I	Dead wood	Ss	**Pac**:P	8
Adomia avicenniae S. Schatz	I	Dead wood	AM	**Mid**:E **Pac**:NSW	202
Aigialus grandis Kohlm. & S. Schatz	I	Dead wood	AC,AM,BG,Cs,RA, RA*,RM,RS,RU,SA, SG	**Atl**:Bz,SC,Tr **Ind**:AI,AP,Bl,Md,MI,NI,Su,Sy,TN **Pac**:Br,Fi,M,O,Q,Si,T	5,9,19,26,27,46,47,50,52,55, 56,64,83,84,110,114,115,135, 138,141,145,161,170,199, 201,227
Aigialus mangrovis Borse	I	Dead wood	AA,AA*,AL*AM, AO,BC*,KC,LR, RA*,RM,RU,SA	**Atl**:Bz **Ind**:AI,AP,Mr,MI,NI,Sy,TN **Pac**:Br,M,Si	9,15,19,27,56,65,110,161, 194,199,201,214,216,217,228
Aigialus parvus S. Schatz & Kohlm.	I	Dead wood Dead leaves	AA,AA*,AL*,AM, AM*,BC*,BG,KC, RA,RA*,RM,RU,SA, SG	**Atl**:F,SC **Ind**:AI,AP,Md,MI,NI,Su,TN **Pac**:Br,M,P,Q,Si	6,8,9,15,19,26,27,46,47,50, 51,55,56,65,83,110115,135, 141,145,161,199,201,214,216 -217
Aigialus rhizophorae Borse	I	Dead wood	RU	**Ind**:MI	15,19,110
Aigialus striatispora K. D. Hyde	I	Dead wood	RA	**Pac**:T	66,84
Aniptodera chesapeakensis Shearer & M.A. Mill.	I	Fern rachis Dead grass Dead wood Dead leaves	AA,AA*,AI,AM,AC, AL*,AS,BC*,NF,PA, RA,RA*,RM,RU,SA, SG,XG*	**Atl**:Bz **Ind**:AI,AP,MI,Mr,SL,Su,Sy **Pac**:Br,HK,J,M,NSW,P,Sh,Si,T,WM	8,9,16,19,27,39,45-47,50-53, 56,57,59,67,68,79,83-84,91, 114,116,118,119,129,138, 161,191,194,200,201,213-216,230,235,246

Aniptodera haispora Vrijmoed, K.D. Hyde & E.B.G. Jones	I	Dead wood	Ax,RA	**Ind**:AP **Pac**:Mc	201,235,236
Aniptodera intermedia K.D. Hyde & Alias	I	Palm petioles	NF	**Pac**:M	79,87
Aniptodera lignatilis K.D. Hyde	I			**Pac**:HK,Mc	235,236
Aniptodera limnetica Shearer	I	Dead wood	BG	**Pac**:O	170
Aniptodera longispora K.D. Hyde	I	Dead wood	BP,OO,RA,RM,RS,RU,SG,TG	**Atl**:Bd,Bz,F **Ind**:Mr **Pac**:Br,M,NSW,O,Q,T,V	56,58,83,84,145,170,194
Aniptodera mangrovei K.D. Hyde	I	Fern rachis Dead wood	AA,AS,BP*,KC, RA,RU,SA,XG	**Ind**:AI,AP,Mr,Su,Sy **Pac**:Br,NSW,P,Sh,Si,T	6,8,9,27,46,47,50-53,55-57, 65,8385,110,114116,194,201, 214-216,235
Aniptodera nypae K.D. Hyde	I	Palm fronds	NF	**Pac**:M	74
Aniptodera salsuginosa Nakagiri & Tad. Ito.	I	Dead wood	BG,RS	**Pac**:J,M?	6, 172
Antennospora quadricornuta (Cribb & J.W. Cribb) T.W. Johnson as *Halosphaeria quadriconuta* Cribb & J. W. Cribb	IS	Dead wood Fruits Palm petioles	AA*,AG,AL*,AM, AM*,BC*,BP*,CE, HT,LR, PC,Px,RA, RM,RS,RU,SD,SG, Wb	**Atl**:An,Ba,Bd,Brz,Bz,C,Cu,EM,F, Gh,Ha,Lb,Mq,Pn,PR,SC,SJ,Tg, Tr,Tx,Vz **Ind**:AI,Jv,KI,LI,Md,MI,Mr,Mz,SL, Su,Sy,TN **Mid**:K,Y **Pac**:Br,Fi,G,H,HK,J,M,P,Q,Si,So,T, Ta,WM	5,6,8,9,12,19,25-27,32,34,39, 45-47,50,52,53,55-57,83,84, 91,106,114,118,122,124-127, 129,134,138,139,141,142, 145,158,161,163,185,194, 195,199,209,214216,220,221, 226-228,231235,241,242,246
Antennospora salina (Meyers) Yusoff, E.B.G. Jones & S.T. Moss as *Arenariomyces salina* Meyers	I	Dead wood	AM*,RA	**Pac**:M,P,WM	5,6,8,9,39
Anthostomella nypae K.D. Hyde, B.S. Lu & Alias	I	Palm petioles	NF	**Pac**:Br,M	79,87
Anthostomella nypensis K.D. Hyde, Alias, & B.S. Lu	I	Palm petioles	NF	**Pac**:M	79,87
Anthostomella nypicola K.D. Hyde, Alias, & B.S. Lu	I	Palm petioles	NF	**Pac**:M	79,87

Anthostomella rhizomorphae (Kunze) Berl. & Voglino	T	Living leaves	RM	**Atl**:PR,Sn	35,124,207
Apioclypea nypicola K. D. Hyde, J. Fröhl & Joanne E. Taylor	I	Palm petioles	NF	**Pac**:M	79
Apiognomonia terminaliae Katum. & Y. Harada	T	Dead leaves	TC	**Pac**:J	193
Arecophila nypae K.D. Hyde	I	Palm petioles	NF	**Pac**:M	77,79
Arenariomyces majusculus Kohlm. & Volkm.-Kohlm.	I	Dead wood	AM	**Ind**:LI **Pac**:H	25,39,30,142
Arenariomyces parvulus Jorg. Koch	I	Shells Sand Dead wood		**Atl**:SC,EM **Pac**:H,Fi,Q,Si,So,T,WM	119,141,142,145,163,227
Arenariomyces trifurcatus Höhnk as *Corollospora trifurcata* (Höhnk) Kohlm. *Halosphaeria trifurcata* (Höhnk.) Cribb & J.W. Cribb	IS	Dead wood Shells Foam Sand	CR,HT,RM	**Atl**:Ba,Bd,Brz,Bz,EM,F,Mq,Sr,Tg, Tr **Ind**:ESA,KI,MI,SL,Sy **Mid**:K **Pac**:Br,Fi,G,H,HK,J,NZ,P,Q,T,WM	8,12,19,32,39,45,47,52,91, 118,119,122,125,126,133, 134,138,139,142,145,151, 165,186,206,220,221,227, 230,241,246
Ascocratera manglicola Kohlm.	I	Dead wood	AA,AG,AM,AO,BG, CE?,Cs,BG,LR,RA, RM,RS,RU,SA,XG	**Atl**:Bz,EM,SC,Tg **Ind**:AI,AP,LI,Md,NI,TN **Pac**:Br,Fi,M,NSW,Q,T	5,9,25,27,56,57,64,83,84,110, 253,138,141,145,199,201,227
Ascotricha chartarum Berk.	T	Living leaves		**Pac**:M,P	153
Asterina ciferriana Petr.	T	Living leaves	CC	**Atl**:DR	193
Asterina derridis Henn.	T	Dead leaves	DT	**Pac**:P	193
Astrosphaeriella nipicola (Cooke & Masse) K.D. Hyde & J. Fröhl.	T	Palm petioles	NF	**Ind**:Jv **Pac**:Br,M	79,86,193
Astrosphaeriella nypae K.D. Hyde	I	Palm petioles	NF	**Pac**:Br	68,86
Astrosphaeriella striataspora (E. Müll.) D. Hakwsw. & Boise as *Trematosphaeria striataspora* E. Müll.	I	Dead wood Palm petioles	NF,RA,RU	**Ind**:AI,NI,Su,Sy **Pac**:Br,M	27,28,47,50,52,56,68,72,86, 110
Bathyascus avicenniae Kohlm.	I	Dead wood	AG,AM	**Atl**:SJ **Ind**:AP	27,126,201
Bathyascus grandisporus K.D. Hyde	I	Dead wood	RA,RU,SA	**Ind**:AI,Sy, **Pac**:Br,T	27,46,47,55,56,83,84,90,110

Bathyascus mangrovei Ravik.& Vittal	I	Dead wood	Rx	**Ind**:TN	199
Belizeana tuberculata Kohlm. & Volkm.-Kohlm.	I	Dead wood	AM,LR,RA,RU,SG, XG	**Atl**:Bz,SC **Ind**:A,INI,Sy,TN **Pac**:Br,M,Mc,NSW,Q,T	27,28,47,52,55,56,83,84,110, 114,138,141,145,199,235,236
Biatriospora marina K.D. Hyde & Borse.	I	Dead wood	AA,AM,AO,RA,RM, RU,SA,SG	**Atl**:Bz **Ind**:AI,LI,Md,MI,Mr,NI,Sy **Pac**:Br,M,P,Q,Si,T	8,9,19,2527,47,80,83,110, 114,115,138,145,194,214-216
Botryosphaeria quercuum (Schwein.) Sacc. As *Physalospora laguncularie* Rehm.	T	Dead leaves	LR	**Atl**:Brz	124,193
Botryosphaeria rhodina (N.E.Stevens) Arx as *Physalospora fusca* N.E. Stevens	T		HT		124,193
Botryosphaeria ribis Grossenb. & Duggar	T		HT,LR		124,193
Capillataspora corticola K.D. Hyde	I	Dead wood	RA,RA*	**Pac**:Br	54,59
Carinispora nypae K.D. Hyde	I	Palm petioles	NF	**Pac**:Br,M	68,72,79
Carinispora velatispora K.D.Hyde	I	Palm rachis	OT	**Pac**:Br	74
Caryosporella rhizophorae Kohlm.	I	Dead wood	AM,RA,RM,RS,RU	**Atl**:Bz,SC **Ind**:AI,ESA,Mr,NI,Su,Sy **Pac**:Br,Fi,M,O,Q,T,WM	27,28,39,45-47,50,52,55,56, 67,83,84,110,114,130,138, 139,141,145,170,194,206,227
Ceriosporopsis halima Linder	I	Dead wood	Ax,Wb	**Atl**:Ba,Brz,EM,F,SC,SJ,Tg,Tx **Ind**:ESA,MI,SL,Sy,TN **Mid**:K **Pac**:H,HK,J,M,NSW,NZQ,Si	12,19,20,32,39,41,45,91,105, 118,121,125,126,139,141, 142,145,163,165,195,206, 215,219,221,231234,241,242, 246
Chaetomastia typhicola (P. Karst.) M.E. Barr as *Leptosphaeria typhicola* P. Karst.	I	Dead wood	AM,RA	**Ind**:AP,ESA	201,206,246
Chaetomium aureum Chivers	D			**Pac**:O	103
Chaetomium globosum Kunze	IT	Endophyte Living leaves Marsh grass Sand	PA,RA,RU	**Ind**:TN **Pac**:HK,M,WM	40,152,191,192,211

Chaetomium nigricolor L.M. Ames	D	Sediment		**Ind**:WBI	198
Corollospora fusca Nakagiri & Tokura	IS	Sand Fruits Dead wood	Ca	**Pac**:H,J	142,175
Corollospora maritima Werderm. as *Peritrichospora integra* Linder	IS	Dead wood Dead leaves Seaweed Seagrass Sand	Ca,HT,RM,Sr,TT, Wb	**Atl**:Ba,Bd,Brz,Bz,C,EM,F,Mq,SC, SJ,Sr,Tg,Tr,Tx, **Ind**:ESA,MI,SL,Sy,TN **Mid**:K **Pac**:AS,Br,Fi,H,HK,J,NZ,Q,Si,So, WM	12,19,39-41,45,47,51,91,119, 122,125,129,133,134,138, 139,141,142,145,151,163, 186,195,206,219,221,227,230 -233,241,242,246
Corollospora pulchella Kohlm., I. Schmidt, & N.B. Nair	I	Dead wood Sand	Po,RA,RM,Sr	**Atl**:Brz,Bz,EM,Lb,Sr,Tg,Tr **Ind**:AP,KI,MI,SA,SL,Sy,TN **Mid**:SB **Pac**:Br,Fi,H,HK,NSW,PI,Q,Si,So,T, WM	12,23,39,40,45,51,67,91,118, 119,122,125,126,129,133, 136,138,139,142,145,163, 195,201,227,231,232,246
Coronopapilla avellina Kohlm. & Volkm.-Kohlm	I	Dead wood	RM	**Atl**:Bz	143
Coronopapilla mangrovei (K.D. Hyde) Kohlm & Volkm.-Kohlm. as *Caryospora mangrovei* K.D. Hyde	I	Dead wood	AM,RU,XG	**Ind**:Mr,AI **Pac**:Br,T	27,52,56,194
Corynascus sepedonium (C.W. Emmons) Arx as *Thielavia sepedonium* C.W. Emmons	D	Sediment		**Ind**:WBI	198
Crinigera maritima I. Schmidt.	I	Dead wood	RM	**Atl**:Brz,Tr **Ind**:SL	12,118,119,126,246
Cryptomyces pongamiae (Berk. & Br.) Sacc.	T	Dead leaves	PP	**Ind**:SL	193
Cryptosphaeria mangrovei K.D. Hyde	I	Dead wood	RA	**Ind**:AP **Pac**:T	73,84,201
Cucullosporella mangrovei (K.D. Hyde & E. B.G. Jones) K.D. Hyde & E.B.G. Jones as *Cucullospora mangrovei* K.D. Hyde and E.B.G. Jones	I	Dead wood Palm fronds	AM*,BG,BP*,NF, RA,RM,RS,XG	**Atl**:F,Tg **Ind**:Mr,Sy **Pac**:Br,M,P,O,T	6,8,9,47,51,52,55,56,68,79, 83,84,89,110,114,115,170, 194

Dactylospora haliotrepha (Kohlm. & E. Kohlm.) Hafellner as *Buellia haliotrepha* Kohlm. & E. Kohlm. as *Kymadiscus haliotrephus* (Kohlm. & E. Kohlm.)Kohlm. & E. Kohlm..	I	Dead wood	AA,AA*,AG,AL*, AM,AO,BC*,BG, BP*,CT,LR,OO,Ps, RA,RM,RS,RU,SA, SG,Wb,XG	**Atl**:Ba,Bd,Bz,F,Mq,SJ,Tr **Mid**:E **Ind**:AI,AP,ESA,LI,Md,MI,Mr,NI, Su,Sy,TN **Pac**:Br,Fi,H,HK,M,NSW,O,P,Q,Sh, T,V,WM	5,6,8,9,15,25-27,39,45-47,50-52,55-57,64,67,83,84,91,108, 114,115,116,119,124,125, 127,129,132-134,138,139, 141,142,145,161,170,185, 194,195,199,201,206,214, 227,228,235,236,245,246
Dactylospora mangrovei E.B.G. Jones, Alias, Abdel-Wahab & S.Y. Hsieh	I	Dead wood	AM,AM*,BP*,KC	**Pac**:HK,M,T,Tw	6,107
Diaporthe salsuginosa Vrijmoed, K.D. Hyde & E.B.G. Jones	I	Dead wood	KC	**Pac**:Mc	235,236
Didymella avicenniae S.D. Patil & Borse	I	Dead wood	AA,SA,SG,XG	**Ind**:MI,Su,TN **Pac**:Br,T	19,47,50,56,83,100,187,199
Emericella nidulans (Eidam)Vuill.	I	Sediment Sand		**Atl**:EM **Ind**:WBI **Pac**:O,WM	29,40,103
Emericella striata (J.N. Rai, J.P. Tewari & Mukerji) Malloch & Cain	I	Sediment		**Ind**:WBI	29
Emericella variecolor Berk. & Broome	I	Sediment		**Ind**:WBI	29
Emericellopsis minima Stolk	D	Sediment		**Ind**:Mz	208
Etheirophora blepharospora (Kohlm. & E. Kohlm.) Kohlm. & Volkm.-Kohlm. as *Keissleriella blepharospora* Kohlm. & E. Kohlm.	I	Dead wood Seedlings	Cs.RA,RS,RM,RU	**Atl**:Ba,Bd,Bz,C,EM,F,SC,SJ,Tr **Ind**:AI,Md,Mr,Sy **Pac**:Br,C,Fi,H,Pu,Q,So	26,27,39,45,55,64,122,124, 126,129,132,134,138,141, 142,145,178,194,227,246
Eudimeriolum avicenniae Hansf.	T	Dead leaves	Ax	**Ind**:Tz	124,193
Eupenicillium parvum (Raper & Fennell) Stolk & Scott	D	Sediment		**Pac**:O	103
Eurotium amstelodami Mangin	I	Sediment		**Ind**:WBI	29
Eurotium chevalieri Mangin	I	Sediment		**Ind**:WBI	29

Eurotium montevidensis (Talice & Mackinnon) Malloch & Cain	I	Sediment		**Ind**:WBI	29
Eurotium rubrum Konig., Spieckermann & Bremer	D	Sediment		**Ind**:WBI **Pac**:O	29,103
Eutypa bathurstensis K.D. Hyde & Rappaz	I	Dead wood	Ax	**Ind**:AP **Pac**:Q	99,201,245
Eutypella naqsii K.D. Hyde	I	Dead wood	Ax	**Pac**:Q	76
Falciformispora lignatilis K.D. Hyde	I	Dead wood		**Pac**:WM	39,67
Fasciatispora lignicola Alias, E.B.G. Jones & Kuthub.	I	Dead wood	BG,RA	**Pac**:M	7,9
Fasciatispora nypae K.D. Hyde	I	Palm fronds	NF	**Pac**:Br,M	60,68,72,79
Fasciatispora petrakii (Mhaskar & V.G. Rao) K.D. Hyde	T	Palm rachis	NF	**Pac**:M	79,193
Frondicola tunitricuspis K.D. Hyde	I	Palm fronds	NF	**Pac**:Br	68,79
Gloniella clavatispora T.D. Steinke & K.D. Hyde	I	Dead wood	AM	**Ind**:ESA	205
Gnomoniella catappae Koord.	T	Dead leaves	TC	**Ind**:Jv	193
Gnomoniella hibisci Swada	T		HT	**Pac**:Tw	193
Halonectria milfordensis E.B.G. Jones	S	Dead wood	AC,KC,Wb	**Pac**:HK	230-233,246
Halorosellinia oceanica (Schatz) Whalley, EBG Jones, K.D. Hyde and Laessøe as *Hypoxylon oceanicum* S. Schatz	I	Dead wood Sand	AA,AC,AM,AM*, AO,BC*,BG,BP,EA, KC,LR,RA,RA*,RM, RU,SA,SG,TG,XG*	**Atl**:Bd,Brz,Bz,F,Tg,Tr **Ind**:AI,AP,Bl,ESA,GI,Mr,NI,Su,Sy **Pac**:Br,H,HK,J,M,Mc,O,P,Q,Sh,Si, T,TW,V	5,6,8,9,27,28,50,52,55-57,59, 65,83,84,108,110,114,161, 170,194,201,203,206,214,216 ,227,228,235,236,239,240
Halosarpheia abonnis Kohlm.	I	Dead wood Sand	AA,AC,AG,AM,CE, HT,KC,LR,NF,OO, RA,RM,RS,RU,SA, SG,XG	**Atl**:Bd,Bz **Ind**:AI,AP,Bl,ESA,LI,MI,Mr,Sy **Mid**:E **Pac**:Br,H,HK,M,NSW,O,Q,Sh,T, WM,V	5,9,19,23,25,27,39,45,47,51, 52,56,57,64,65,79,84,110, 114,129,138,142,145,170, 194,201,206,228,235,236,245
Halosarpheia cincinnatula Shearer & J.L. Crane	I	Fern rachis Dead wood	AM*?,AS,BC*	**Ind**:Sy **Pac**:Br,M,Si	6,9,45,47,51,53,110,161,214, 215

Halosarpheia fibrosa Kohlm. & E. Kohlm.	IS	Dead wood	AG,AM?,LR,RA, RM,RS,RU,SA,TG	**Atl**:Bd,Brz,Bz,F **Ind**:ESA?MI,Mr,Sy **Mid**:K **Pac**:Br,HK,M,Mc,NSW,O,Q,Sh,V	5,9,12,17,19,45, 47,55-57,91, 126,129,134,138,145,170, 184,194,206,235,236,242,246
Halosarpheia kandeliae Abdel-Wahab & E.B.G. Jones	I	Dead wood	KC	**Pac**:HK	1
Halosarpheia lotica Shearer	I	Dead wood	AA*,AM,BC*	**Pac**:M,Sh,Si	9,110,114,214-217,235
Halosarpheia marina (Cribb & J.W. Cribb) Kohlm. as *Gnomonia marina* Cribb & J.W. Cribb *Aniptodera marina* ?	I	Fern rachis Dead wood	AA,AA*,AI?,AL*, AM,AM*,AS,BC*, BP,BP*,CT,NF,RA, RA*,RM,RR,RU,SA, SG,XG,XG*	**Atl**:F,Lb **Ind**:AP,Bl,ESA,LI,MI,Mr,Su,Sy,TN **Pac**:AS,Br,H,HK,M,NSW,P,Q,Sh,Si, T,WM,V	5,6,8,9,17,19,25,32,39,45-47, 50-53,55-57,59,64,67,68,79, 83,84,110,114-116,124,129, 142,145,158,161,194,199, 200,201,206,214-217,246
Halosarpheia minuta W.F. Leong	I	Dead wood	AA,AA*,AC,AG*, AM,AM*,BC*,BP*, RA*,RU,SA,SG	**Ind**:AI,AP **Pac**:Br,HK,M,Si,T	6,9,27,56,59,83,114,161,162, 201,235
Halosarpheia ratnagiriensis S.D. Patil & Borse	I	Dead wood	AA,AC,AM,AM*, BP*,NF,RA,RU,SA, Sd,SG,XG,XG*	**Ind**:AI,AP,Bl,Brz,MI,Mr,Md,NI,Su, Sy **Pac**:Br,M,P,Sh,Si,T	5,6,9,17,19,26,27,45,47,50-52,55,56,59,68,83,84,100, 114116,129,184,194,201,214, 235
Halosarpheia retorquens Shearer & J.L. Crane	I	Dead wood Fern rachis Dead leaves	AA,AA*,AI,AM*, AS,BP*,HT,NF,RA*, RU	**Ind**:ESA,.MI,SL **Pac**:Br,H,HK,M,Mc,P,Sh,Si,V	6,9,17,19,47,53,56,57,68,79, 110,114,116,118,129,139, 142,161,163,200,206,214, 216,235,236
Halosarpheia trullifera (Kohlm.) E.B.G. Jones, S.T. Moss & Cuomo as *Remispora trullifera* Kohlm.	I	Dead wood	AM?	**Ind**:ESA? **Pac**:M	114,206
Halosarpheia unicellularis Abdel-Wahab & E.B.G. Jones	I	Dead wood	AM	**Mid**:E	2
Halosarpheia viscidula (Kohlm.) Shearer & J.L. Crane as *Haligena viscidula* Kohlm.	I	Dead wood	BP*?, RM,RR,Wb	**Atl**:Brz,IC,Lb **Ind**:Mr **Pac**:HK,M?,Q	6,12,122,124,132,145,194, 231,232,246

Halosarpheia viscosa (I. Schmidt) Shearer & J.L. Crane	I	Dead wood	AA,AC,AM,NF,RA, RU,SA,SG,XG	**Ind**:AP,ESA,Mr,Su,Sy **Pac**:Br,Fi?,P,Q?,Sh,T	45,47,50-52,55,56,68,79,83, 84,91,110,116,145,194,201, 206,227,235
Halosphaeria appendiculata Linder	I	Dead wood		**Atl**:Brz,WSA **Pac**:Br?,J,Q,V	12,32,41,44,51,57,91,121, 165,246
Halosphaeria cucullata (Kohlm.) Kohlm. As *Remispora cucullata* Kohlm.	I	Dead wood	AA,AG,AM*?,CE, HT,LR,PF,RM,SG,Wb	**Atl**:Brz,Bz,F **Ind**:ESA,KI,MI,Mr,TN **Pac**:Br,H,J,M?,So,T,WG,WM	5,12,16,19,39,47,51,56,83, 126,138,142,194,199,227, 228,243,246
Halosphaeria galerita (Tubaki) I. Schmidt as *Ceriosporopsis submarina* (Linder) Müller *Lentescospora submarina* Linder *Remispora galerita* Tubaki	I	Dead wood		**Atl**:Brz,EM,TX **Ind**:Sy **Pac**:Br,H,J	12,125,126,129,133,142,165, 246
Halosphaeria hamata (Höhnk)Kohlm.	I	Dead wood	Wb	**Atl**:Brz **Pac**:HK	12,231-234,246
Halosphaeria maritima (Linder) Kohlm. as *Remispora maritima* Linder	IS	Dead wood	RM,Wb	**Atl**:Brz **Mid**:K **Pac**:H,J	12,220,221,242,246
Halosphaeria quadriremis (Höhnk) Kohlm. as *Remispora quadriremis* Höhnk	IS	Dead wood	RA,RU,Wb	**Pac**:HK,J,M	108,114,220,221,231-234,246
Halosphaeria salina (Meyers) Kohlm. as *Remispora salina* (Meyers) Kohlm. *Arenariomyces salinus* Meyers	IS	Dead wood Sand	AG,CQ,CR,HT,RM?, SA,TT,Wb	**Atl**:Ba,Brz,Bz,C,EM,F,Lb,Mq,SC, Sr,Tg,Tr **Ind**:AI,ESA,MI,SL,Sy **Mid**:K **Pac**:Br,Fi,H,HK,Ms,Q,So,T,WM	12,16,19,27,40,45,47,51,91, 118,119,122,125129,138,139, 141,142,145,227,232,233, 241,242,246
Halosphaeriopsis mediosetigera (Cribb & J.W. Cribb) T. W. Johnson as *Halosphaeria mediosetigera* Cribb & J.W. Cribb	I	Dead wood	AG,AN,RR,Wb	**Atl**:Brz,EM,Lb,Tx,WSA **Ind**:ESA **Pac**:J,Q	12,32,39,41,121,246
Hapsidascus hadrus Kohlm. & Volkm. –Kohlm.	I	Dead wood	RM	**Atl**:Bz,Tg	146
Heleococcum japonense Tubaki	IS	Dead wood	Ax,RA	**Ind**:AP,J,Jv,TN	199,201,209,246

Helicascus kanaloanus Kohlm.	I	Dead wood Sand	AA,AC,KC,RM, RU,SA,SD,SP,XG?	**Ind**:AI,ESA,Md,MI,Su? **Pac**:Br,H,M,P,Si, T?	8,9,19,26,27,47,50-52,57,61, 65,83,114,115,116,124,125, 142,187,206,214,216,246
Helicascus nypae K.D. Hyde	I	Palm frond	NF	**Pac**:Br,M	61,68,72,79
Helotium inocarpi Henn.	T	Dead leaves	IF	**Pac**:PG	193
Hemisartorya maritima J.N. Rai & H.J. Chowdhery	D	Sediment		**Ind**:WBI	29
Herpotrichia nypicola K.D. Hyde & Alias	I	Palm petiole	NF	**Pac**:M	79
Hypophloeda rhizospora K.D. Hyde & E.B.G. Jones	I	Dead wood	RA,RA*,RU	**Ind**:Sy **Pac**:Br,M,T	5,55,56,59,83,84, 94
Hypoxylon bovei Speg.		Dead wood		**Pac**:HK,M,Sw,T	239
Hypoxylon hypomiltum Mont.	I	Dead wood	RA	**Pac**:T	84
Hypoxylon ochraceum Henn. as *Hypoxylon nectriodeum* Sacc. & Trotter		Dead wood		**Atl**:Sr **Ind**:ESA **Pac**:HK,M,PG, "Australia"	239
Hypoxylon rubiginosum (Pers.)Fr.		Dead wood		**Pac**:HK,M	239
Hypoxylon subgilvum Berk. & Broome		Dead wood		**Pac**:Br,HK,M,T	239
Irene laguncularíae (Earle) Toro	T	Living leaves	LR	**Atl**:PR	124,193
Irene sepulta (Pat.)Toro	T	Dead leaves	Ax		124,193
Irenopsis molleriana (G. Winter) F. Stevens	T	Dead leaves	HT	**Atl**:PR	193
Julella avicenniae (Borse) K.D. Hyde as *Pleospora avicenniae* Borse	I	Dead wood	AA,AM,RA	**Ind**:AI,AP,Md,MI **Mid**:E **Pac**:M,Q	5,9,18,19,26,27,64,110,145, 201,245
Kallichroma glabrum (Kohlm.) Kohlm. & Volkm.-Kohlm.	I	Dead wood		**Pac**:M	9

Kallichroma tethys (Kohlm. & E. Kohlm.) Kohlm. & Volkm.-Kohlm. as *Hydronectria tethys* Kohlm. & E. Kohlm.	I	Dead wood	AA,AC,AG,AM,AO, BG,BP*,CE,HT,LR, Ps,RA,RM,RS,RU, SA,SG,TG	**Atl**:Ba,Bd,Bz,EM,F,Sc,SJ,Tg **Ind**:AI,AP,ESA,Mr,NI,Sy **Pac**:Br,Fi,H,HK,M,NSW,Q,So,T, WM	5,6,9,27,28,39,45-47,51,52, 55-57,83,84,91,108,114,115, 124-126,129,132-134,138, 139,141,142,145,148,157, 194,201,206,227,228,235, 236,246
Kirschsteiniothelia maritima (Linder) D. Hawksw.	I	Dead wood	RA?	**Ind**:AP?	150,201
Lanspora coronata K.D. Hyde & E.B.G. Jones	I	Dead wood	HT	**Ind**:Mr,Sy **Pac**:H,M	45,91,110,114,142
Lasionectria dothideicola Petch	T	Dead leaves	HT	**Ind**:SL	193
Lautospora gigantea K.D. Hyde & E.B.G. Jones	I	Dead wood	Ax,Rx,SA,SG	**Ind**:AP,Mr **Pac**:Br,T	57,83,92,194,201
Lecanidion atratum (Hedw.) Rabenh.	I	Dead wood	Ax,RA.	**Ind**:AP	201
Leptosphaeria australiensis (Cribb & J.W. Cribb) G.C. Hughes as *Metasphaeria australiensis* Cribb & J.W. Cribb	I	Fern rachis Dead wood	AA,AC,AG,AM, AM*,AO,AS,BG, BP*,Ca,CE,HT,LR, NF,Ps,RA,RM,RR, RS,RU,SA,SG,ST, TG,XG,XG*	**Atl**:Ba,Bd,Brz,Bz,C,EM,F,Lb,Mq, SC,SJ,Sr,Tr,V **Ind**:AI,AP,ESA,LI,Md,MI,Mr,NI, Su,Sy,TN **Pac**:Br,Fi,G,H,HK,M,P,Q,So,T,WM, V	5,6,9,11,17,19,25-27,31,34, 39,45-47,50-53,55-57,59,64, 68,79,83,84,91,114-116,124, 125,127,129,133,134,138, 139,141,142,145,158,165, 194,199,201,206,227,228, 235,236,246
Leptosphaeria avicenniae Kohlm. & E. Kohlm.	I	Dead wood	AA,Af,AG,AN,KC, RA?,RM,RU?,XG	**Atl**:Ba,Bd,Brz,Bz,EM,F,Lb,Mq **Pac**:Br,Mc,Sr,T	39,46,47,51,52,55,56,65,68, 122, 124,126,127,129,132-134,138,235,236,246
Leptosphaeria neomaritima Gessn. & Kohlm. as *Leptosphaeria maritima* (Cooke & Plowe) Sacc.	I	Dead leaves Sea grass Seedlings	RM,Sl	**Atl**:F **Pac**:J	91,165,174,178,246
Leptosphaeria nypicola K.D. Hyde & Alias	I	Palm petiole	NF	**Ind**:Sy? **Pac**:M	79,87
Leptosphaeria orae-maris Linder	I	Dead wood Sea grass	AM,Sl	**Atl**:F **Pac**:HK,J	121,165,220,221,230,246

Leptosphaeria pelagica E.B.G. Jones	I	Dead wood	RU	**Ind**:Mr	194,246
Leptosphaeria peruviana Speg.	I	Dead wood	Ax,RA	**Ind**:AP	201,246
Leptosphaerulina mangrovei Inderb. & E.B.G. Jones	I	Dead wood	KC	**Pac**:HK	102
Lignincola laevis Höhnk	I	Fern rachis Dead wood Dead leaves Dead marsh grass	AA,AA*,AI,AL*, AM,AM*,AS,BC*, BG,BN,,BP,BP*,Cs, HT,KC,LR,NF,PA, Pc,PF,RA,RA*,RM, RS,RU,SA,SD,SG, Wb	**Atl**:Bd,Brz,Bz,Cy,F,Mq,SC,Tr **Ind**:AI,AP,ESA,LI,Md,MI,Mr,NI, Su,Sy,TN **Pac**:Br,Fi,H,HK,J,M,Mc,P,Q,Sh,Si, So,T,WG,WM	5,6,8,9,11,12,19,20,25-27,39, 45-47,50-53,55-57,64,65,67, 68,83,84,91,114,-116,124-129,133,138,139,141,142, 161,165,185,191,192,194, 195,200,206,214-217,220,221,227, 228,230-236,246
Lignincola longirostris (Cribb & J.W. Cribb) Kohlm. as *Gnomonia longirostris* Cribb & J.W. Cribb	I	Dead wood Dead leaves		**Atl**:Bd,Tg,Tx **Ind**:AP,ESA,KI,MI,TN **Pac**:Br,HK,H,J,M,NSW,P,Q,Sh,Si, So,T	6,8,9,19,20,32,57,68,72,79, 83,84,108,114,120,124,126, 129,134,139,142,145,158, 199,201,206,213-216,220, 221,227,235,236,246
Lignincola nypae K.D. Hyde & Alias	I	Palm petiole	NF	**Pac**:M	79,87
Lignincola tropica Kohlm.	I	Dead wood	AA,AM,AM*,BP*, RA,RM,SA,SG,XG	**Atl**:Bz,EM **Ind**:AP,Mr **Pac**:Br,M,P,Si,T,WM	6,8,9,39,46,47,51,55,56,83, 110,129,138,194,201
Lineolata rhizophorae (Kohlm. & E. Kohlm.) Kohlm. & Volkm.-Kohlm. as *Didymosphaeria rhizophorae* Kohlm. & E. Kohlm.	I	Dead wood	AM,Cs,RA,RM,RS, RU	**Atl**:Ba,Brz,Bz,C,F,SC,SJ,Tg,Tx,Vz **Ind**:AI,AP,Md,Mr,NI,Sy,TN **Mid**:E **Pac**:G,M,O,P,Q,Si,T,WM	9,26-28,39,64,83,84,116,124, 126,129,138,139,141,145, 170,194,199,201,214,216, 245,246
Linocarpon angustatum K.D. Hyde & Alias	I	Palm petioles	NF	**Pac**:M	78,79
Linocarpon appendiculatum K.D. Hyde	I	Dead wood Palm fronds	NF	**Ind**:Su **Pac**:Br,M,PNG,T	48,50,68,69,79
Linocarpon bipolare K.D. Hyde	I	Palm fronds	NF	**Pac**:Br	68,69,79
Linocarpon livistonae (Henn.) K.D. Hyde	I, T	Palm petiole	NF,Ls	**Atl**:Brz,FG,Gu **Pac**:M,P,Q,Sw,Tw	48,69,79
Linocarpon longisporum K.D. Hyde	I	Palm fronds	NF	**Pac**:Br	68,69,79

Linocarpon nypae (Henn.) K.D. Hyde	I	Palm fronds	NF	**Pac**:Br,M,P,T	9,48,68,69,7279
Linocarpon pandani Syd. & P. Syd.	I	Dead wood?	NF,PL	**Pac**:Br,P,Tw	47,48,51,69
Lophiostoma mangrovei Kohlm. & Vittal	I	Dead wood	AM,AO,BG,RA, RM,RU,SA,SG	**Atl:**Bz,SC **Ind**:AI,AP,ESA,LI,Md,MI,Mr,NI, TN **Pac**:M,P,T	8,9,19,25-27,83,84,110,114, 137,138,141,194,199,201,206
Lophiotrema littorale Speg.	I	Seedlings	RM	**Atl**:F	177,178,246
Lulworthia floridana Meyers	I	Dead wood Dead leaves	RM,Wb	**Atl**:F **Mid**:Y **Ind**:MI **Pac**:Si,NZ	35,106,246
Lulworthia grandispora Meyers	I	Dead wood Dead leaves Fruits Palm fronds Seedlings	AA,AC,AG,AM, AM*,AO,BG,BP, BP*,Ca,HT,KC,LR, NF,RA,RA*,RM, RR,RU,SA,SD,SG, XG,XG*,Wb	**Atl**:Ba,Bd,Brz,Bz,F,Gh,Lb,SC,Tg,Tr **Ind**:AI,AP,ESA,LI,Md,MI,NI,Su,Sy, TN **Mid**:E,K **Pac**:Br,Fi,H,HK,J,M,NSW,P,Si,T,V, WG,WM	5,6,8,9,16,19,25-27,35,39,45-47,50-52,55-57,59,65,67,68, 79,83,84,114-116,126,129, 133,134,138,139,141,142, 163,165,177,178,183,199,201 ,206,214-217,227,228,235, 242,245,246
Lulworthia longispora Cribb & J.W. Cribb	I	Dead wood	AM	**Pac**:Q	31,246
Lulworthia medusa (Ellis & Everh.) Cribb & J.W. Cribb	I	Dead wood Sea grass Dead leaves	AA,AA*,AL*,AM, RA*,RM,RU,Sl	**Atl**:Ba,Bd,Brz,F,PR,Tx **Ind**:MI,TN **Pac**:H,M,Q,Si	12,20,31,35,44,105,114,161, 163,165,177,178,195,214-216
Manglicola guatemalensis Kohlm. & E. Kohlm.	I	Dead wood	RA,RA*,RM	**Pac**:Br,WG	46,47,55,59,133,246
Mangrovispora pemphii K.D. Hyde & Nakagiri	I	Dead wood	Pc	**Pac**:Q	62
Marinosphaera mangrovei K.D. Hyde	I	Dead wood	AA,AC,AI,AM,BG, BP*,CT,Hs,HT,Ps, RA,RS,RU,SG,ST, XG	**Ind**:AP,Bl,ESA,Md,Mr,Su **Pac**:Br,H,HK,LI,M,Mc,P,Q,Si,Sh, So,T	5,8,9,25-27,46,50,52,55,56, 64,83,84,108,110,114,194, 200,201,206,214-216,227, 235,236
Massarina acrostichi K.D. Hyde	I	Fern rachids	AS	**Pac**:Br	53

Massarina armatispora K.D. Hyde, Vrijmoed, Chinnaraj, & E.B.G. Jones	I	Dead wood	AM,AM*,AO,BP*	**Ind**:AI,GI,Ka,NI **Pac**:M,Mc	6,27,101,235,236
Massarina lacertensis Kohlm. & Volkm.-Kohlm.	I	Dead wood	RS,RU	**Ind**:Mr **Pac**:Q	145,194
Massarina ramunculicola K.D. Hyde	I	Dead wood	BP*,RA,RS	**Ind**:Mr **Pac**:M,O,T	5,6,9,63,84,170,194
Massarina thalassiae Kohlm. & Volkm.-Kohlm.	I	Dead wood Dead marsh grass	AG,AM,BG,CE, CT,LR,PA,Pc,RA, RM,RS,RU,SG,XG	**Atl**:Bz,F,SC **Ind**:AI,AP,LI,Md,Mr,NI,Sy,TN **Pac**:Br,Fi,G,HK,M,Q,T,WM	5,9,25-27,39,46,47,56,64,83, 84,110,114,138,139,141,145, 191,192,199,201,227,235,236
Massarina velatospora K.D. Hyde & Borse	I	Dead wood	AA,AC,AM,BG,RA, RM,RS,RU,SA,SC, SG,ST,XG	**Atl**:Bz,SC,Mq,Tr **Ind**:AI,AP,Bl,LI,Md,MI,Mr,NI,Su, Sy,TN **Pac**:Br,HK,M,P,Q,T	5,9,19,25-27,46,47,50-52,55, 56,63,81,83,84,110,114-116, 141,145,194,199,201,235,236
Melaspilea mangrovei Vrijmoed, K.D. Hyde & E.B.G. Jones	I	Dead wood	Pc,RA	**Pac**:HK,M,Q	5,237
Meliola brugierae Syd.	T	Dead leaves	BH	**Pac**:P	193
Meliola ceriopsis Hansf.	T	Living leaves	CT	**Pac**:Br	193
Meliola cylindrophora Rehm	T	Living leaves	CC	**Pac**:P	193
Meliola elodea Syd.	T	Dead leaves	CT,XG	**Ind**:BN	193
Meliola hippomanae F. Stevens	T	Living leaves	HM	**Atl**:Pn	193
Meliola nigra F. St1vens	T	Living leaves	LR	**Atl**:PR	124,193
Meliola pavoniae Cif.	T	Living leaves	Pv	**Atl**:DR	193,248
Meliola pelliculosa Syd.	T	Living leaves	Lu	**Pac**:P	193
Meliola procera Cif.	T	Living leaves	HT	**Atl**:DR	193,247
Meliola triumfettae F. Stevens	T	Dead leaves	HT	**Atl**:PR	124,193
Microascus cinereus Curzi	D	Sediment		**Pac**:O	103
Micropeltis laguncularíae G. Winter	T		LR		124,193
Moellerodiscus conocarpi (Seaver & Watterson) Dumont	T	Dead leaves	CE	**Atl**:Bd	193
Mollisia petiolorum Cash	T	Live? leaves	HT	**Pac**:H	124,193,250
Mycosphaerella devia Petr. & Cif.	T	Living leaves	DE	**Atl**:DR	193

Mycosphaerella pneumatophorae Kohlm.	I	Dead wood	AA,AA*,Af,AG, AL*,AM,AN,RA*, RM	**Atl**:Ba,Bz,C,EM,F,Lb,SJ,Tg **Ind**:AP,ESA,Sy **Pac**:Br,M,Si	39,45,56,122,124,126,129, 133,138,139,161,201,206, 214-216,246,251
Mycosphaerella pongamieae (Racib.) Sivan as *Stigmatea pongamiae* Racib.	T	Dead leaves	PP	**Ind**:Jv	193
Mycosphaerella salicorniae (Auersw.) Lindau	I	Dead wood Culms	RA?,RM,SV	**Atl**:Ba,Bd,Bz,EM **Pac**:T?,WM	39,83,84,126,129,134,138, 246
Nais glitra J.L. Crane & Shearer	I	Dead wood	AM,AL*,AM*,BC*, BP*,Cs,RA,RU,SA, SG,Wb	**Ind**:AI,AP,ESA,Su,TN **Pac**:Br,HK,M,NSW,Si,T,V	6,9,27,50,56,57,64,83,84,110, 114,161,199,201,206,214, 216,235,236
Nais inornata Kohlm.	I	Dead wood	AA*,AL*,BC*,RA*	**Mid**:Jv,K **Pac**:HK,Si	161,209,216,230-234,241,246
Neocosmospora vasinfecta (Arx) E.F. Sm. as *Neocosmospora africana* Arx	D	Sediment		**Ind**:Mz	212
Neolinocarpon globosicarpum K.D. Hyde	I	Palm fronds	NF	**Pac**:Br,M	68,72,79
Neolinocarpon nypicola K.D. Hyde & Alias	IT	Palm rachid	NF	**Pac**:M	78,79,193
Neosartorya fischeri (Wehmer) Malloch & Cain	D	Sediment		**Pac**:O	103
Neosartorya quadricincita (Vuill) Malloch & Cain	D	Sediment		**Pac**:O	103
Nimbospora octonae Kohlm.	I	Dead wood	Px	**Ind**:MI **Pac**:Br,H	16,19,47,131,139,142
Nipicola carbonispora K.D. Hyde	I	Palm fronds	NF	**Pac**:Br	68,70,79
Nipicola selangorensis K.D. Hyde	I	Palm fronds	NF	**Pac**:M	74,79
Ocostaspora apilongissima E.B.G. Jones, R.G. Johnson, & S.T. Moss	I	Dead wood	Pd	**Ind**:Sy **Pac**:H?,Q?,WM "San Juan Is. USA"	39,45,67,91,113,142,145

Ophiobolus australiensis Johnson & Sparrow as *Ophiobolus littoralis* Cribb & J.W.Cribb	I	Dead wood	AM	**Pac**:Q	32,57,124,158,246
Ophiodeira monosemeia Kohlm. & Volkm.-Kohlm.	I	Dead wood	AG,RA,RM,SG,XG	**Atl**:Bz,SC,Tg **Ind**:AP **Pac**:Br,T	55,56,83,84,141,201,228
Oxydothis nypae K.D. Hyde & Nakagiri	I	Palm petioles	NF	**Pac**:Br,M,T	68,72,75,79,97
Oxydothis nypicola K.D. Hyde	T	Palm rachid	NF	**Pac**:Br,M	75,79,193
Paraliomyces lentiferus Kohlm.	I	Dead wood	AG,AN,RM	**Atl**:EM,F **Ind**:TN	39,121,122,124,126,246
Passeriniella obiones (P. Crouan & H. Crouan) K.D. Hyde & Mouzouras as *Leptosphaeria obiones* (P. Crouan & H. Crouan) Saccardo *Leptosphaeria discors* Saccardo & Ellis *Metasphaeria discors* (Saccardo & Ellis) Saccardo	IS	Dead wood Sea grass	Ax,RA,Sl	**Atl**:F,Tx **Ind**:AP,MI,TN **Pac**:HK,J,Q	19,33,165,195,201,220,221, 231,232,246
Passeriniella savoryellopsis K.D. Hyde & Mouzouras	I	Dead wood	AA,AM,BG,RA,RM, RU,SA,SG,XG	**Atl**:Bz,SC **Ind**:AI,Mr,NI,Sy **Pac**:Br,M,Si,T	9,27,28,47,55,56,83,84,96, 110,141,161,194,214,216,228
Patellaria atrata (Hedw.) Fr.	T	Stems	HT	**Pac**:H	124,193,250
Payosphaeria minuta W.F. Leong	IS	Dead wood	AA*,AG*,AM,BC*, BG,CT,HT,RA*,RU, SA	**Ind**:AI,LI,Md,NI **Pac**:H,M,Si	25-27,114,160,161,227
Pedumispora rhizophorae K.D. Hyde & E.B.G. Jones	I	Dead wood	RA,RU	**Ind**:AP,Sy	95,201
Penicilliopsis clavariiformis Solms	D	Sediment		**Pac**:O	103
Peroneutypella graphidioides Syd. & P. Syd.	T	Dead wood	TC	**Pac**:P	103
Petriella setifera (Alf. Schmidt) Curzi	S	Dead wood	Wb	**Pac**:HK	231-234

Phaeosphaeria halima (T.W. Johnson) Shoemaker & C.E. Babc. as *Leptosphaeria halima* T.W. Johnson	I	Dead wood Dead leaves	AG,BG	**Atl**:F,TX **Ind**:ESA	120,165,206,246
Phaeosphaeria minuta W.F. Leong	I	Dead wood	AM*,BP*	**Pac**:M	6
Phomatospora acrostichi K.D. Hyde	I	Fern rachis	AS	**Pac**:Br	49,53
Phomatospora kandelae K.D. Hyde	I	Dead wood	KC	**Pac**:Br	65
Phomatospora nypae K.D. Hyde	I	Palm petiole	NF	**Pac**:M	72,79
Phomatospora nypicola K.D. Hyde & Alias	I	Palm petiole	NF	**Pac**:M	79,87
Phragmodothis hibisci Sawada	T	Dead leaves	HT	**Pac**:Tw	124, 193
Phyllachora minuta Henn. as *Physalospora hibisci* Racib.	T	Dead leaves	HT	**Ind**:Jv	124,193
Phyllochora yapensis (Henn.) Syd.	T	Living leaves	Ds	**Pac**:HK	193
Physalospora rhizophorae Bat. & H. Maia	T	Living leaves	RM	**Atl**:Brz	35,124,193
Physalosporopsis rhizophoricola Bat. & H. Maia	T	Living leaves	RM	**Atl**:Brz	35,124,193
Pleospora pelagica T. W. Johnson		Dead leaves	AG,Sl	**Atl**:F,TX	120,165,246
Polyrhizon terminaliae Syd. & P. Syd.	T	Dead leaves	TC	“India”	193
Polystigma sonneratiae Petr.	T	Dead leaves Live leaves	SA,SC	**Pac**:Q,P	82,193
Pseudallescheria ellipsoidea (Arx & Fassat.) McGinnis, A.A. Padhye & Ajello as *Petriellidium ellipsoideum* Arx & Fassat.	S	Dead wood	Wb	**Pac**:HK	231-234
Pterosporidium rhizomorphae (Kunze ex Curr.) W.H. Ho & K.D. Hyde	T	Living leaves	RM	**Atl**:Bd,DR,PR,Sn	43,193
Pterosporidium rhizophorae (Vizioli) W. H. Ho & K.D. Hyde As *Anthostomella rhizophorae* Vizioli.	T	Living leaves	RM	**Atl**:Bd,PR,Vz	35,43,124,193

Pycnidiophora aurantiaca (J.N. Rai & J.P. Tewari) Mukerji & V.R. Rao as *Preussia aurantiaca* J.N. Rai & J.P. Tewari	D	Sediment		**Ind**:WBI	198
Pyrenographa xylographoides Aptroot	I	Dead wood	CT,RA,SA	**Pac**:M,Q	4,5
Quintaria lignatilis (Kohlm.) Kohlm.& Volkm.-Kohlm. As *Trematosphaeria lignatilis* Kohlm.	I	Dead wood	AA,AM,AO,BG, BP*,CT,Pc,RA,RM, RS,RU,SA,SG,Xs	**Atl**:Bz,SC **Ind**:AI,AP,LI,Md,MI,Mr,NI,Su,Sy, TN **Pac**:Br,M,O,P,Q,So,T,WM	5,6,8,9,23,25-27,39,45-47,50, 52,55,56,64,83,84,91,110, 114,129,138,141,145,170, 194,199,201,227
Remispora crispa Kohlm.	I	Dead wood		**Atl**:Lb,Mq **Ind**:Sy **Pac**:Br,H	45,47,51,91,126,142
Rhipidocarpon javanicum (Pat.) Theiss. & Syd.	T	Palm petioles	NF	**Pac**:P "Indonesia"	79,193
Rhizophila marina K.D. Hyde & E.B.G. Jones	I	Dead wood	AM,BG,RA,RS,RU	**Ind**:AI,AP,Bl,ESA,Ka, Md,Mr,NI,Su,Sy **Pac**:Br,M,Q,T	5,9,26-28,50-52,55,56,83,84, 93,110,145,194,201,206
Saccardoella mangrovei K.D. Hyde	I	Dead wood	Pc,RA,SG	**Pac**:NSW,T	71,84
Saccardoella marinospora K.D. Hyde	I	Dead wood	Ax,KC,NF	**Ind**:AP,Md,Mr **Pac**:Br,HK,Sh,T "Australia"	26,71,194,201,235,236
Saccardoella rhizophorae K.D. Hyde	I	Dead wood	AM*,BG,BP*,RA, RM	**Ind**:AP **Pac**:Fi,H,M,T	5,71,201,227
Salsuginea ramicola K.D. Hyde	I	Dead wood	AA,AC,AM,KC, SA,XG	**Ind**:AI **Pac**:Br,P,T	8,27,61,65
Savoryella lignicola E.B.G. Jones & R.A. Eaton	I	Fern rachis Dead wood	AA,AC,AM,AM*, AS,BC*,BP*,HT,NF, RA,RU,KC,SA,SG, ST,XG	**Ind**:AI,AP,ESA,LI,Md,MI,Mr,SL, Su,Sy,TN **Pac**:Br,H,HK,M,Mc,P,Sh,Si,T,WM	5,6,8,9,19,20,25-27,39,45-47, 50-53,55,56,65,67,79,83,109, 111,114-116,118,119,161, 194,195,201,206,214-216, 227,230,235,236,246
Savoryella longispora E.B.G. Jones & K.D. Hyde	I	Dead wood	AM,AM*,BG,BP*, Cs,RA	**Pac**:Br,M,Q,Si,T	6,9,64,84,110

Savoryella paucispora (Cribb & J.W. Cribb) J. Koch as *Leptosphaeria paucispora* Cribb & J.W. Cribb	IS	Dead wood	AA,AM,AM*,AO, BC*,BG,BP*,HT, RA*,RU,SA,Wb	**Ind**:AI,ESA,LI,Mr,SL,Su,Sy **Pac**:Br,H,HK,M,Mc,O,P,Q,Si,T	6,8,9,25,27,33,45-47,50,91, 114-116,118,119,129,142, 161,170,194,206,214-216, 232,233,235,236,246
Schizothyrium laguncularіae (G. Winter) Arx	T	Dead leaves	LR	**Atl**:Brz	124,193
Setella halophila F.E. Fisher	T		AC	**Pac**:Q	193
Sphaerostilbe dubia Berk.	T	Bark	AC	"Australia"	193
Sphaerostilbe repens Berk. & Broome	T	Live roots	RM	**Pac**:H	157
Sphaerulina orae-maris Linder	I	Dead wood	RA*	**Atl**:F **Pac**:M,Si	52,56,105,161,165,214,215, 246
Sporormiella grandispora S.I. Ahmed & Cain ex J.C. Krug	I	Dead wood	Rx	**Ind**:TN	199
Sporormiella minima (Auersw.) S.I. Ahmed & Cain	E	Living leaves Endophyte	AI,RA,RU,SM,So	**Ind**:TN	210,211
Stictis conocarpi Seaver & Waterson	T	Dead? leaves	CE	**Atl**:Bd	193,249
Swampomyces aegyptiacus Abdel-Wahab, El-Sharouney & E.B.G. Jones	I	Dead wood	AM,BP*,KC*,SA*	**Mid**:E	245
Swampomyces armeniacus Kohlm. & Volkm.-Kohlm.	I	Dead wood	AG,AM,RA?,RM, RU,SG?,XG?	**Atl**:Bz,SC **Ind**:AI,Mr,NI,Sy,TN **Pac**:Br?,M,Q,T?	27,56,83,84,98,110,114,138, 141,145,194,199,228
Swampomyces clavatispora Abdel-Wahab, El Sharouney & E.B.G. Jones	I	Dead wood	AM, BP*,KC*	**Mid**:E	245
Swampomyces triseptatus K.D. Hyde & Nakagiri	I	Dead wood	AC,AM*,Ax,BP*,RA,RS,RU,XG	**Ind**:Mr,Su **Pac**:Br,M,O,PNG,Q,T	6,9,64,84,98,170,194
Talaromyces flavus (Klöcker) Stolk & Samson	D	Sediment		**Pac**:O	103,104
Talaromyces helicus (Raper & Fennell) C.R. Benj.	D	Sediment		**Pac**:O	103
Talaromyces stipitatus (Thom) C.R. Benj.	D	Sediment		**Pac**:O	103

Talaromyces ucrainicus (Panas.) Udagawa as *Talaromyces ohiensis* Pitt.	D	Sediment		**Pac**:O	103
Talaromyces wortmannii (Klöcker) C.R. Benj.	D	Sediment		**Pac**:O	103
Thalassogena sphaerica Kohlm. & Volkm.-Kohlm.	IS	Dead wood	AM,RA,RU	**Atl**:Bz **Ind**:ESA,Mr **Pac**:Br,T	55,56,83,84,110,140,194,206
Thielavia terricola (J.C. Gilman & E.V. Abbot) C.W. Emmons	I	Sand Sediment		**Ind**:WBI **Pac**:O,WM	40,103,198
Tirispora unicaudata E.B.G. Jones & Vrijmoed	I	Dead wood	AI,AM*,BP*	**Pac**:HK,M	6,117,200
Tirisporella beccariana (Ces.) E.B.G. Jones, K.D. Hyde & Alias	I	Dead leaves	NF	**Pac**:M,P	8,79,112
Torpedospora radiata Meyers	I	Dead wood Sand Sea grass Dead leaves	AG,AN,CE,CR,HT, Pc,RA,RM,Wb	**Atl**:Ba,Brz,Bz,EM,F,IC,Mq,SC,SJ, Sr,ST,Tg **Ind**:Jv,Lb,KI,LI,MI,SL,Sy,TN **Mid**:K **Pac**:AS,Br,G,H,HK,J,M,NZ,P,Q,So, T,WM	5,8,9,12,19,20,25,39,40,45, 47,51,55,56,91,118,119,121, 124-129,133,138,139,141, 142,145,165,195,209,220, 221,226,227,228,231,232, 241,242,246
Trematosphaeria lineolatispora K.D. Hyde	I	Dead wood		**Pac**:HK,Mc,WM	39,67,235,236
Trematosphaeria mangrovis Kohlm.	I	Dead wood	RR	**Atl**:Lb **Ind**:Mr **Pac**:M,P	8,114,123,124,194,246
Tubeufia setosa Sivan. & W.H. Hsieh	I	Dead wood	RA	**Ind**:AP	201
Tunicatispora australiensis K.D.Hyde	I	Dead wood	AM	**Pac**:NSW,V	57

Verruculina enalia (Kohlm.) Kohlm. & Volkm.-Kohlm. as *Didymosphaeria enalia* Kohlm.	I	Dead wood Dead marsh grass	AA,AA*,Af,AG, AL*,AM,AM*,AN, AO,BC*,BG,BM, BP*,CE,Cq,Cs,LR, PA,Pc,RA,RA*,RM, RR,RS,RU,KC,NF, SA,SG,ST,XG	**Atl**:Ba,Bd,Brz,Bz,EM,F,LB,Mq,SC, Sr,Tg,Tr,Tx **Ind**:AI,AP,ESA,LI,Md,MI,Mr,NI, Sy,TN **Pac**:Br,Fi,G,H,HK,M,Mc,Ms,O,P,Q, Sh,Si,So,Su,T,V,WG,WM	5,6,8,9,12,15,19,25-27,39,45-47,50-52,55-57,65,67,68,79, 83,84,91,108,114116,122, 124,126,127,129,133,134, 138,139,141,142,145,157, 161,170,187,191,194,199, 201,206,214-217,226-228, 235,236,246,251
Vibrissea nypicola K.D. Hyde & Alias	I	Palm petiole	NF	**Pac**:Br,M	79,87
Westerdykella dispersa (Clum) Cejp & Milko as *Pycnidiophora dispersa* Clum *Preussia dispersa* (Clum) Cain	D	Roots Sediment	RS	**Ind**:WBI **Pac**:H,O	104,156,198
Westerdykella multispora (Saito & Minoura) Cejp & Milko as *Preussia multispora* (Saito & Minoura) Cain *Pycnidiophora multispora* (Saito & Minoura) J.W. Thompson & Backus	D	Sediment		**Ind**:WBI **Pac**:H,O	103,156,157,198
Westerdykella ornata Stolk	D	Sediment		**Pac**:Mz	208
Zopfiella latipes (N. Lundq.) Malloch & Cain	I	Dead wood Dead marsh grass	AA,PA	**Ind**:AP,KI,MI **Pac**:HK,J	23,201,246
Zopfiella marina Furuya & Udagawa	I	Dead wood	Ax	**Ind**:AP	201,246
Mitosporic Fungi					
Acremonium albamense Morgan-Jones	D	Sediment		**Pac**:O	103
Acremonium minutisporum (Sukapure & Thirum.) W. Gams	I	Dead leaves		**Pac**:J	174
Acremonium murorum (Corda) W.Gams as *Gliomastix murorum* (Corda) S. Hughes	D	Roots Sediment	AM	**Pac**:O	104
Acremonium stictum W. Gams as *Cephalosporium acremonium* Corda	I	Dead leaves	RM	**Atl**:Brz	11

Acremonium terricola (J.H. Mill, Giddens & A.A. Foster) W. Gams	D	Sediment		**Pac**:O	103
Acrostalagmus albus Preuss	T	Living leaves		**Pac**:M	153
Albophoma yamanashiensis Tak. Kobay., Masuma, Omura & K.Watan.	D	Sediment		**Pac**:O	104
Alternaria alternata (Fr.) Keissl.	DI	Roots Seedlings Sand Marsh grass Endophyte	PA,RM,RS,SA,So	**Atl**:F **Ind**:TN **Pac**:HK,O	104,178,191,192,210
Alternaria tenuissima (Kunze) Wiltshire	T	Living leaves		**Pac**:M	153
Arthrinium phaeospermum (Corda) M.B.Ellis	D	Sediment		**Pac**:O	103,104
Arthrobotrys dactyloides Dreschler	I	Dead leaves	RM	**Atl**:Brz	11
Arthrobotrys oligospora Fresen.	I	Dead wood		**Pac**:M	9
Ascochyta salicorniae Magnus	I	Culms	SB	**Ind**:MI	13,19,246
Ascochytella rhizophoropsis Cif. & Gonz. Frag.	T	Living leaves	RM	**Atl**:DR	35,124,193
Ascochytella thespesiae Gonz. Frag. & Cif.	T	Dead leaves	TP	**Atl**:DR	193
Aspergillus aculeatus Iizuka	D	Roots	AM	**Pac**:O	104
Aspergillus aeneus Sappa	D	Sediment		**Ind**:WBI	29
Aspergillus allahabadi B.S. Mehrotra & Agnihorti	D	Sediment		**Ind**:WBI	29
Aspergillus candidus Link	D T	Sediment Living leaves		**Ind**:TN,WBI **Pac**:M	10,29,153,198
Aspergillus carneus (Tiegh.)Blochwitz	D	Sediment		**Ind**:WBI **Pac**:H	29,156

Aspergillus clavatus Desm.	D	Sediment		**Ind**:WBI **Pac**:O	29,103,104
Aspergillus curviformis H.J. Chowdhery & J.N. Rai	D	Sediment		**Ind**: WBI	29
Aspergillus flavescens Wreden	I	Dead wood	AM	**Ind**:GI	10
Aspergillus flavipes (Bainier & Sartory) Thom & Church	D	Sediment		**Ind**:WBI **Pac**:H	29,156,157
Aspergillus flavus Link	I, T	Dead leaves Sediment Living leaves	AG	**Atl**:TX,EM **Ind**:WBI **Pac**:M,WM	10,29,40,120,153,198
Aspergillus foetidus Thom & Raper	D	Sediment		**Ind**:WBI	29
Aspergillus fumigatus Fresen	D, T	Sediment Living leaves		**Ind**:GI,WBI **Pac**:H,M,O	10,29,103,153,156,198
Aspergillus glaucus (L.) Link	E	Living leaves Endophyte	RU	**Ind**:TN	211
Aspergillus globosus H.J. Chowdhery & J.N. Rai	D	Sediment		**Ind**:WBI	29
Aspergillus janus Raper & Thom	D	Sediment		**Ind**:WBI	29
Aspergillus japonicus Saito	D	Sediment		**Ind**:WBI	29
Aspergillus nidulans (Eidam) G. Winter	D	Sediment		**Ind**:TN,WBI	10,198
Aspergillus niger Tiegh.	DI T	Dead leaves Living leaves Sediment Seedlings	AA,AG,AM,RA,RM, RU	**Atl**:F,Tx,EM **Ind**:TN,WBI **Pac**:H,M,O,Si,WM	10,29,40,104,120,153,156, 157, 177,178,198
Aspergillus ochraceus G. Wilh.	D	Sediment		**Ind**:WBI	29
Aspergillus ornatus Raper, Fennell & Tresner	I	Seedlings	RM	**Atl**:F	178
Aspergillus oryzae (Ahlb.) E. Cohn	I	Stems	AM	**Ind**:GI	10
Aspergillus panamensis Raper & Thom	D	Sediment		**Ind**:WBI	29
Aspergillus parasiticus Speare	D	Sediment		**Ind**:WBI	29

Aspergillus penicilliformis Kamyschko	D	Sediment		**Ind**:WBI	29
Aspergillus phoenicis (Corda) Thom & Currie	D	Sediment		**Ind**:WBI	29
Aspergillus puniceus Kwon-Chung & Fennell	D	Sediment		**Ind**:WBI	29
Aspergillus repens (Corda) Sacc.	S	Seedlings	RM	**Atl**:F	177,178
Aspergillus ruber Thom & Church	D	Sediment		**Ind**:WBI	198
Aspergillus rugulosus Thom & Raper	D	Sediment		**Ind**:WBI	29,198
Aspergillus sclerotiorum G.A. Huber	D	Sediment		**Ind**:WBI **Pac**:H	29,156
Aspergillus stellatus Curzi as *Aspergillus variecolor* Thom & Raper	D	Sediment		**Ind**:WBI	198
Aspergillus striatus J.N. Rai, J.P. Tewari & Mukerji	D	Sediment		**Ind**:WBI	198
Aspergillus sulphureus (Fres.) Thom & Church	D	Sediment		**Ind**:WBI	29
Aspergillus sydowii (Bainier & Sartory) Thom & Church	D	Sediment		**Ind**:TN,WBI	10,29,198
Aspergillus tamarii Kita	D	Sediment		**Ind**:WBI	29
Aspergillus terreus Thom	IS T	Dead leaves Living leaves Sediment Seedlings	AG,AM,RM	**Atl**:EM,F,Tx **Ind**:GI,TN,WBI **Pac**:M,O,WM	10,29,40,103,120,153,178, 198
Aspergillus tubingensis Mosseray	D	Sediment		**Ind**:WBI	29
Aspergillus unguis (Émile-Weil & L. Gaudin) Thom & Raper	D	Sediment		**Ind**:WBI	29
Aspergillus ustus (Bainier) Thom & Church	D	Sediment		**Ind**:WBI **Pac**:H	29,156
Aspergillus versicolor (Vuill.) Tirab.	D	Sediment		**Ind**:WBI	29,198
Aspergillus wentii Wehmer	D	Sediment		**Ind**:WBI	29
Asteromyces cruciatus Moreau & R. Moreau	IS	Dead wood	AM	**Ind**:ESA	206

Aureobasidium pullulans (de Bary) Arnaud as *Pullularia pullulans* (de Bary)Berkhout	DI T	Dead leaves Sand Sediment Seedlings Sea grass	CT,RM,TT	**Atl**:EM,F,Vz **Ind**:GI **Pac**:J,H,M,WM	10,40,152,153,168,177,178, 181,246
Bactrodesmium linderi (J.L. Crane & Shearer) M.E. Palm & E.L. Stewart as *Trichocladium linderii* J. L. Crane & Shearer	I	Dead wood	AM*,BG,BP*,RA	**Ind**:AP,ESA,MI,Sy **Pac**:Br,HK,M,Mc,Sh,Si	6,9,13,19,45,55,56,91,114, 201,206,214,216,235,236
Beltrania rhombica Penz.	T	Living leaves		**Pac**:M	153
Botryodiplodia theobromae Pat.	T	Dead leaves Living leaves		**Pac**:M	152,153
Botryodiplodia thespesiae Petr. & Cif.	T	Dead wood	TP	**Atl**:DR	193
Botryosphaeria rhodina (Berk. & M.A. Curtis) Arx Diplodia natalensis Pole-Evans	T		HT		124,193
Botryotrichum piluliferum Sacc & Marchal	T	Live leaves		**Pac**:M	153
Botrytis argillacea Cooke	T	Dead wood	AE,Ax	"Australia"	124,193
Botrytis cinerea Pers.	DI	Sediment Sea grass		**Atl**:F **Ind**:WBI	168,198
Botrytis terrestris C.N. Jensen	D	Sediment		**Ind**:WBI	198
Camarosporium palliatum Kohlm & E. Kohlm.	IS T	Endophyte Dead wood	AA,AD,SD,SM	**Ind**:MI,TN	22,210,246
Camarosporium propinquum (Sacc.) Sacc.	T	Endophyte	AD	**Ind**:TN	210
Camarosporium roumeguerii Sacc.	IS	Dead leaves Dead wood	AG,AM?,SB	**Atl**:Tx **Ind**:AP,ESA,MI **Mid**:K **Pac**:WM	19,22,39,120,201,206,241, 246
Capnobotrys hibisci Mercado	T	Dead leaves	HT	**Atl**:Cu	193
Cephalosporium avellaneum De Vries	D	Sediment		**Pac**:H	156
Cercospora conocarpi Chupp & A.S. Mull	T	Dead leaves	CE	**Atl**:Vz	193

Cercospora geraisensis Chupp	T	Dead leaves	TC	**Atl**:Brz	193
Cercospora hibisci Tracy & Earle	T	Dead leaves	HT	**Atl**:LA	124,193
Cercospora rhizophorae Creager	T	Living leaves Dead leaves	RM	**Atl**:F	30,35,124,164,193
Cercosporella thespesiae Thirum. & Naras.	T		TP	"India"	193
Circinotrichum maculiforme Nees	T	Dead leaves Live leaves	BP	**Pac**:M	152,153
Cirrenalia basiminuta Raghuk. & Zainal	I	Dead wood	AA*,AI,BC*,RA,RU	**Ind**:AP,LI,Mr,TN **Mid**:K **Pac**:H,HK,M,Si	9,110,161,194,197,199,200, 201,214,215,227
Cirrenalia macrocephala (Kohlm.) Meyers & R.T. Moore	IS	Dead wood Dead leaves	AM,RA,RM,RU, Wb	**Atl**:F,Sr,TX **Ind**:AP,ESA,Jv,MI,SL,TN **Mid**:K **Pac**:HK,J,Sh	3,13,19,35,106,118,126, 199,201,206,209,219,221, 231-236,241,242,246
Cirrenalia pseudomacrocephala Kohlm.	I	Dead wood Fern rachis Seedlings Dead leaves	AG,AM,AS,BG,BP*, RA,RA*,RM,RU, XG*	**Atl**:Bd,EM,F **Ind**:AI,Mr,Su,Sy **Pac**:Br,HK,J,M,T	5,6,8,27,39,45,47,50,52,53, 55,56,59,83,84,91,114,122, 126,134,174,178,194,231, 232,246
Cirrenalia pygmea Kohlm.	IS	Dead wood	AM,AM*,AO,BC*, BG,BP,BP*,CT,KC, NF,RA,RA*,RM,RR, RS,RU,SA,SG,Wb, XG*	**Atl**:Brz,Lb,Sr,Tr **Ind**:AI,AP,Jv,LI,Md,MI,Mr,NI,SL, Su,Sy,TN **Pac**:Br,Fi,M,Sh,Si,T,WM	3,5,6,9,13,19,25-27,39,45-47,50-52,55,56,59,65,68,79, 83,114,115,118,119,122,124, 126,129,161,194,199,201, 209,214,216,227,235,246,251
Cirrenalia tropicalis Kohlm.	IS	Dead wood Sand Dead leaves	AA,AM*,BG,BP, BP*,NF,RA,RA*, RM,RR,RS,RU,SA, XG*	**Atl**:Brz,Lb,Sr **Ind**:AP,Jv,Mr,NI,Su,Sy **Pac**:Br,M,O,P,Si,T,WM	3,6,8,9,11,12,27,39,40,45-47, 50-52,55,56,59,68,79,83,84, 91,114-116,122,124,170,194, 201,209,214,216,246
Cladosporium avellaneum G.A. de Vries	D	Sediment		**Pac**:H	156

Cladosporium cladosporioides (Fresen.) G.A. de Vries	D	Dead leaves Roots Seedlings Sediment	AG,RM,RS	**Atl**:EM,F,Tx **Pac**:J,O,WM	40,103,104,120,174,177,178
Cladosporium herbarum Pers.	I	Dead wood	AM	**Atl**:EM **Ind**:MI **Pac**:WM	10,40
Cladosporium indicum J.N. Rai, J.P. Tewari & Mukerji	D	Sediment		**Ind**:WBI	198
Cladosporium marinum A.K. Pal & Purkay	T	Living leaves	AM	**Ind**:WBI **Pac**:HK	193
Cladosporium oxysporium Berk. & M.A. Curtis	T	Dead leaves Seedlings Fruits	AG,CT	**Atl**:Tx **Pac**:M	120,152
Clavatospora bulbosa (Anastasiou) Nakagiri & Tubaki *Clavariopsis bulbosa* Anastasiou	IS	Dead wood Dead leaves	AI,AM,RA*	**Atl**:Brz,Lb,Tr **Ind**:AI,ESA,Jv,Md,MI,SL,Sy,TN **Mid**:K **Pac**:AS,Br,H,HK,J,M,P,Si	8,12,13,19,26,27,45,47,51,91, 114,118,119,122,125,126, 142,161,163,195,200,206, 209,213,214,216,220,221, 226,230,235,242,246
Colletotrichum hibiscola Rangel	T		HT	**Atl**:Brz	124,193
Corynespora cassiicola (Berk. & M.A. Curtis) C.T. Wei	IT	Dead leaves Living leaves Fruit Dead wood	AI,CT	**Pac**:HK,M	152,153,200
Curvularia clavata B.L. Jain	T	Living leaves		**Pac**:M	153
Curvularia lunata (Wakker) Boedijn	DI T	Sediment Living leaves Dead leaves Fruit	AR,CT	**Ind**:WBI **Pac**:M,WM	40,152,153,198,218
Curvularia senegalensis (Speg.) Subram.	IT	Fruit Living leaves	CT	**Pac**:M,WM	40,152,153

Cylindrocarpon destractans (Zinssn.) Scholten	D	Roots	Lu,RS,SA	**Pac**:O	104
Cylindrocladium lucidum C. Booth	D	Sediment		**Pac**:H	157
Cylindrocladium parvum P.J. Anderson	D	Roots Sediment	RM	**Pac**:H	156,157
Cytospora rhizophorae Kohlm. & E. Kohlm.	I	Dead wood	AM,RA,RM,RR,RU, XG	**Atl**:Ba,Bd,Bz,EM,F,Lb,Mq,SC,SJ, Sr,Tg,Tr **Ind**:AI,AP,Md,Mr,Sy **Pac**:Br,H.M,PG,Q,WG,WM	26,27,39,46,56,114,115,126, 127,129,133,134,138,139, 141,142,145,177,178,194, 201,246
Deptothyrium rhizophorae Gonz. Frag. & Cif.	T	Dead leaves	RM	**Atl**:DR	35
Dictyochaeta simplex (S.Hughes & W.B. Kendr.)Hol.-Jech. as *Codinaea simplex* S. Hughes & W.B. Kendr	T	Dead leaves Living leaves		**Pac**:M	152,153
Dictyochaeta tumidoseta Kuthub. & Nawawi	T	Dead rachis	OT	**Pac**:M	193
Dictyosporium elegans Corda	I	Dead wood	RS	**Pac**:O	170
Dictyosporium pelagicum (Linder) G.C. Hughes	IS	Dead wood Fern rachis Dead leaves	AA,AM*,AS,BC*, BP*,NF,RA,RM,Wb	**Atl**:Cm,F,IC,Tx **Ind**:MI,Sy **Mid**:K **Pac**:Br,HK,M,NZ,Si,WM	5,6,9,22,35,39,44,45,47,51, 53,55,56,67,68,79,91,105, 161,214-216,230-236,242, 246
Diplodia catappae Cooke	T	Nuts	TC	"Bengal India"	193
Diplodia inocarpi Sacc.	T	Fruit	IF	**Pac**:Si	193
Dothiorella indica Soni, Dadwal & Jamaluddin	T	Pods	PP	"India"	193
Drechslera biseptata (Sacc. & Roum) M.J. Richardson & E.M. Fraser	IT	Living leaves Sand		**Atl**:EM **Pac**:M	40,153
Drechslera halodes (Drechsler) Subram. & B.L. Jain	IT	Dead leaves Dead wood Living leaves		**Atl**:F **Ind**:TN **Pac**:M,Si	152,153,163,214

Drechslera rostrata (Drechsler) M.J. Richardson & E.M. Fraser	T	Dead leaves Living leaves		**Pac**:M	152,153
Dwibeeja sundara Subram.	T	Dead wood	CI	**Pac**:Si	193
Ellisembia vaga (Nees & T. Nees) Subram.	I	Dead wood	Ax,RA	**Ind**:AP	201
Endothiella coccolobii Roane	T		CE	**Atl**:Bd	193
Engyodontium album (Limber) de Hoog	D	Roots	AM	**Pac**:O	104
Epicoccum nigrum Link as *Epicoccum purpurascens* Ehrenb.	I	Dead leaves Dead wood	AG,RA,RM	**Atl**:Brz,Tx **Ind**:AP,Tn	11,120,199,201
Exosporium calophylli Syd.	T		CI	**Pac**:P	193
Fusarium aquaeductum (Rabenh. & Radlk.) Sacc.	D	Sediment		**Ind**:WBI	198
Fusarium bostrycoides Wollenw. & Reinking	D	Sediment		**Pac**:H	156
Fusarium lateritium Nees	D	Sediment		**Pac**:H	156
Fusarium moniliforme J. Sheld	D	Roots	BG,SA	**Pac**:O	104
Fusarium oxysporum Schltdl.	D	Roots Sediment	RM	**Ind**:WBI **Pac**:H	157,198
Fusarium roseum Link	D	Roots Sediment	RM	**Pac**:H	156,157
Fusarium solani (Mart.) Sacc.	D	Roots Sediment	RM	**Atl**:EM **Pac**:H,WM	40,156,157
Fusarium sporotrichioides Sherb.	D	Sediment		**Pac**:H	156
Fusicoccum microspermum Har. & P. Karst	T	Dead leaves	TC	**Atl**:DR	193
Gliocladium deliquescens Sopp	D	Sediment		**Pac**:H	156,157
Gliocladium roseum Bainier	D	Roots Sediment	RM	**Pac**:H,O	104,157
Gliocladium virens J.H. Mill., Giddens & A.A. Foster	D	Roots Sediment	Lu	**Pac**:O	103,104

Gloeosporium barringtoniae F. Stevens & P.A. Young	T	Dead leaves	BA	**Pac**:H	193
Gloeosporium calophylli Trel.	T	Fruits	CI	**Pac**:Kb	193
Gloeosporium hibisci-tiliacea Sawada	T	Living leaves	HT	**Pac**:Tw	193
Gloeosporium inocarpi Sacc.	T	Fruit	IF	**Pac**:Si	193
Gloeosporium terminaliae P. Syd. & E. J. Butler	T	Dead leaves	TC	**Ind**:BM	193
Graphium putredinis (Corda) S. Hughes	T	Living leaves		**Pac**:M	153
Gyrothrix circinata (Berk. & M.A.Curtis) S. Hughes	T	Living leaves		**Pac**:M	153
Haplosporella thespesiae Cif.	T	Dead leaves	TP	**Atl**:DR	193
Harknessia terminaliae Sawada	T	Dead leaves	TC	**Pac**:Tw	193
Harposporium baculiforme Dreschler	S	Seedlings	RM	**Atl**:F	177,178
Helicorhoidion nypicola K.D. Hyde & Goh	I		NF	**Pac**:Br,M	79,87
Helminthosporium bonducellae Henn.	T	Dead leaves	CB	**Atl**:Brz	193
Helminthosporium glabroides F. Stevens	T		LR		124,193
Helminthosporium subsimile Sacc.	T	Dead leaves	BH	**Pac**:Si	193
Hemidonthis pellitiformis Cif.	T	Dead leaves	TP	**Atl**:DR	193
Hendersonia catappae Petr.	T	Dead leaves	TC	**Pac**:P	193
Humicola fuscoatra Traaen	I	Seedlings	RM	**Atl**:F	178
Idriella lunata P.E. Nelson & S. Wilh.	I	Dead leaves	RM	**Atl**:F **Pac**:J	35,174
Kyphophora avicenniae B. Sutton	T	Dead leaves	AM	**Pac**:Q	193
Lasiothyrium cycloschizon Syd. & P. Syd.	T	Living leaves Dead leaves	AC	**Pac**:P	193
Leptographium lundbergii Lagerb. & Melin	D	Sediment		**Pac**:H	156
Leptothyrium rhizophorae Gonz., Frag. & Cif.	T	Dead leaves	RM	**Atl**:DR	124,193

Macrophoma calophylli Syd.	T		CI	"India"	193
Mariammaea elegans (Corda) Samson as *Paecilomyces elegans* Corda	T	Seedling Fruits Living leaves	CT	**Pac**:M	152,153
Memnoniella echinata (Rivolta) Galloway	T	Living leaves		**Pac**:M	153
Menisporopsis theobromae S. Hughes	T	Living leaves		**Pac**:M	153
Metarhizium anisopliae (Metschn.)Sorokin	D	Sediment		**Pac**:H,O	103,104,156,157
Microdochium dimerum (Penz.) Arx as *Fusarium dimerum* Penz.	D	Sediment		**Pac**:H	156,157
Monodictys pelagica (T.W. Johnson) E.B.G. Jones	I	Dead wood	NF,SA,Wb	**Atl**:IC,Sr **Ind**:AI,LI,Sy,TN **Mid**:K **Pac**:Br,HK,J,NZ,Q,WM	3,25,27,39,44,45-47,51,64, 67,68,79,91,105,195,199, 220,221,230-234,242,246
Mycocentrolobium platysporum Goos	I	Dead wood	RS	**Pac**:O	170
Mycovellosiella pongamiae (A.K.Kar & M. Mandal) Deighton as *Cercospora pongamiae* A.K.Kar & M. Mandal	T		PP	**Ind**:WBI	193
Nigrospora sphaerica (Sacc.) E.W. Mason	DI	Dead leaves Sea grass Sediment	AA,AG,AR,RA,TT	**Atl**:EM,F,Tx **Ind**:WBI **Pac**:Si,WM	40,120,168,198,218
Nypaella frondicola K.D. Hyde & B. Sutton	I	Palm petioles	NF	**Pac**:Br,M	79,100
Paecilomyces indicus J.N. Rai, J.P. Tewari & Mukerji	D	Sediment		**Ind**:WBI	198
Paecilomyces lilacinus (Thom) Samson As *Penicillium lilacinum* Thom	D	Sediment		**Pac**:H,O	103,104,156
Papulaspora halima Anast.	IS	Dead wood Seedlings	RM,Wb	**Atl**:F,SJ,Tg **Pac**:HK,J,M,Si	126,163,178,214-216,219, 221,230-234,246

Penicillium citrinum Thom. as *Penicillium steckii* Zalewski	D S	Sediment Roots Seedlings	BG,RM,RS	**Atl**:F **Pac**:H,O	103,104,157,177,178
Penicillium corylophilum Dierckx	D	Sediment		**Pac**:H,O	103,104,156
Penicillium crustosum Thom	D	Sediment		**Pac**:O	103,104
Penicillium decumbens Thom.	D	Sediment		**Pac**:H	156
Penicillium diversum Raper & Fennell	D	Sediment		**Pac**:H	156
Penicillium emmonsii Pitt. as *Penicillium stipitatum* Thom	D	Sediment		**Ind**:WBI	198
Penicillium funiculosum Thom	D	Sediment		**Ind**:GI **Pac**:H,O	10,104,156,157
Penicilium glabrum (Wehmer) Westling as *Penicillium frequetans* Westling	D	Sediment		**Pac**:H	156,157
Penicillium janczewskii Zalewski as *Penicillium nigricans* Bainer	D	Sediment		**Ind**:WBI	198
Penicillium melinii Thom.	D	Sediment		**Pac**:H	156
Penicillium nalgiovense Laxa	D	Sediment		**Pac**:H	157
Penicillium ochrochloron Biourge	D	Sediment		**Pac**:H	156
Penicillium oxalicum Currie & Thom	D	Sediment		**Pac**:H	156
Penicillium purpurogenum Stoll	D	Sediment		**Pac**:H,O	103,104,156
Penicillium roseo-purpureum Dierckx	D	Sediment Seedlings	RM	**Atl**:F **Ind**:WBI	178,198
Penicillium rugulosum Thom	D	Sediment		**Pac**:O	103
Penicillium simplicissimum (Oudem.) Thom as *Penicillium janthinellum* Biourge	D	Sediment		**Pac**:H,O	103,104,156
Penicillium variable Sopp.	D	Sediment		**Pac**:H	156
Penicillium vermiculatum P.A. Dang	D	Sediment		**Pac**:H	156,157
Periconia byssoides Pers.	T	Dead leaves	AG	**Atl**:Tx	120

Periconia prolifica Anast.	I, S	Fern rachis Dead wood Seedlings	AG,AI,AM,AM*, AO,AS,BG,BP*,CE, HT,LR,Pc,PF,RA, RM,RU,SA,Wb,XG*	**Atl**:Ba,Bd,Brz,Bz,EM,F,Gh,Mq,Sr, Tg **Ind**:AI,AP,ESA,Jv,LI,Md,MI,Mr,NI, Su,Sy,TN **Mid**:K,SB **Pac**:Br,H,HK,M,NS,P,Q,Sh,Si,So, T,V,WG,WM	3,5,6,8,9,12,13,19,25-27,39, 44-47,50,51,53,55-57,59,67, 83,84,91,108,114,124,126, 127,129,133,134,138,139, 142,145,163,177,178,194, 195,199,200,206,209,214-216,227,228,230-235,242,246
Pestalotia heterochornis Guba	D	Sediment		**Pac**:H	156
Pestalotia longiaristata Maubl.	T	Dead leaves	RM	**Atl**:F	35,124,193
Pestalotia macrotrichia Kleb.	T	Dead leaves	AG	**Atl**:Tx	120
Pestalotiopsis agallochae A.K. Pal & Purkay	T	Dead leaves	EA	**Ind**:WBI	193
Pestalotiopsis disseminata (Thüm) Steyaert as *Pestalotia disseminata* Thüm	T	Dead leaves	RM	**Atl**:F	35,124,193
Pestalotiopsis guepini (Desm.) Steyaert as *Pestalotia guepini* Desm.	T	Dead leaves Seedlings Living leaves Fruits	AA,AO,BP,CT,RA, RM,RU,SA,XM	**Pac**:M	124,152,153,193
Pestalotiopsis versicolor (Speg.) Steyaert as *Pestalotia versicolor* Speg.	T	Dead leaves Fruits Livng leaves	CT,RM,RU,SA	**Atl**:Bd **Pac**:M	35,124,152,153,193
Pestalotiopsis zahlbruckneriana (Henn.) P.L. Zhu,Q.X. Ge, T. Xu as *Pestalotia zahlbruckneriana* Henn.	T	Dead leaves	RM	**Atl**:F	35,124,193
Phaeoisariopsis caesalpiniae J. Yen, A.K. Kar, & B.K.Das	T	Leaves	CB	**Ind**:WBI	193
Phaeothyrium pulchellum Petr.	T		AC	**Pac**:HC	193
Phialophora fastigiata (Lagerb. & Melin) Conant	D	Sediment		**Pac**:O	103,104
Phialophorophoma litoralis Linder	I	Dead wood	AA?,AC?,AI,AM, NF?,RA?,SA?,SG?, XG*?	**Pac**:Br,HK,NSW,Q,T?,V	31,47,55-57,59,68,83,84,124, 158,230,246

Phoma capitulum Panwar, P.N. Mathur & Thirum.	D	Sediment		**Ind**:BI	188
Phoma herbarum Westend.	D	Sediment		**Pac**:O	103
Phoma multipora Pawar, Mathur & Thirum.	D	Sediment		**Ind**:BI	188
Phoma ostiolata Pawar, Mathur & Thirum.	D	Sediment		**Ind**:BI	188
Phoma rhizophorae Tassi	T	Dead wood	RM	"West Africa"	124,193
Phoma suadae Jaap	I	Dead wood	RA	**Pac**:M	5,246
Phomopsis mangrovei K.D. Hyde	I	Dead wood	RA,RU	**Atl**:AI,AP **Pac**:T	27,84,201
Phomopsis obscurans (Ellis & Everh.) B. Sutton	I	Dead leaves	RM	**Atl**:Brz	11
Phomopsis rhizophorae Bat. & H. Maia	T	Living leaves	RM	**Atl**:Brz	35,124,193
Phomopsis terminaliae (Henn.) B. Sutton	T	Dead leaves	TC	**Atl**:Brz **Pac**:Tw	193
Phomopsis thespesiae Luke & C.N. Reddy	T	Dead leaves	TP	"India"	193
Phragmospathula phoenicis Subram. & N.G. Nair	I	Dead wood	RS	**Pac**:O	170
Phyllosticta bonduc F. Stevens	T	Dead leaves	CB	**Atl**:PR	193
Phyllosticta catappae Syd.	T	Dead leaves	TC	**Ind**:Bm	193
Phyllosticta hiratsukae Kobay. & Onuki	T	Dead leaves	RS	**Pac**:J	193
Phyllosticta latispora Verwoerd & Du Plessis	T	Dead leaves	TC	"South Africa"	193
Phyllostictina elodea Syd.	T	Dead leaves	BG	**Pac**:P	193
Piricauda elliptica (Cooke) R.T. Moore as *Sporidesmium elipticum* Cooke	I	Dead wood		**Ind**:Sy **Pac**:Br	45,47,91
Plectophomella nypae K.D. Hyde & B. Sutton	I	Palm petiole	NF	**Pac**:Br,M	79,100

Pleurophomopsis nypae K.D. Hyde & B. Sutton	I	Palm petiole		**Pac**:Br	79,100
Podosporium consors Sacc.	T	Dead leaves	BH	**Pac**:Si	193
Pseudocercospora allophylorum (A.K. Kar & M. Mandal) Bagyan, U. Braun & Jagad. as *Cercospora allophylorum* A.K. Kar & M. Mandal	T		AY	**Ind**:WBI	193
Pseudocercospora catappae as *Cercospora catappae* Henn.	T	Dead leaves	TC	**Ind**:Z **Pac**:Tw	193
Pseudocercospora hibiscina (Ellis & Everh.) Y.L. Guo & J. Liu as *Cercospora hibiscina* Ellis & Everh.	T	Dead leaves	HT	"Mexico"	124,193
Pseudocercospora pongamiae-pinnatae M.R. Ram & Mallaiah	T	Living leaves	PP	"India"	193
Pseudocercospora rhizophoricola Deighton	T	Dead leaves	RR	**Atl**:Sr	193
Pseudocochilobolus eragrostidis Tsuda & Ueyama as *Curvularia eragrostidis* (Henn.) J.A. Mey	T	Living leaves		**Pac**:M	153
Pseudocochliobolus pallescens Tsuda & Ueyama as *Curvularia pallescens* Boedijn	IT	Living leaves		**Atl**:EM **Pac**:M	40,153
Ramularia catappae Racib.	T	Dead leaves	TC	**Ind**:Jv	193
Rhabdospora avicenniae Kohlm. & E. Kohlm.	I	Dead wood	AG,Af,AM,BG,HT,\ RA	**Atl**:Ba,Bd,Bz,C,F,Lb **Ind**:ESA **Pac**:M,WM	5,9,39,114,126,129,134,138, 206,246
Robillarda rhizophorae Kohlm.	I	Dead wood	RM	**Atl**:F **Pac**:Br,H	47,126,142,157,177,178,246
Schizotrichum conocarpi Seaver & Waterston	T	Dead leaves	CE	**Atl**:Bd	193
Sclerotium rolfsii Sacc.	D	Sediment		**Ind**:WBI	198

Scolecobasidium arenarium (Nicot) M.B. Ellis as *Dendryphiella arenaria* Nicot	I	Dead leaves Dead wood Sea grass	AG,RM,TT,Wb	**Atl**:Brz,F,Tx **Ind**:Jv **Pac**:M,P,WM	11,39,40,114,116,120,168, 209,246
Scolecobasidium humicola G.L. Barron & L.V. Busch	DI	Roots Seedlings Leaves	AM,RM	**Atl**:F **Pac**:O,J	104,174,178
Scolecobasidium salinum (G.K. Sutherl.) M.B. Ellis as *Dendryphiella salina* (G.K. Sutherl.)Pugh & Nicot	DI S	Dead wood Seedlings Sediment	RM	**Atl**:F **Ind**:GI **Pac**:H,P	8,10,126,128,151,157,177, 178,246
Scolecotrichum barringtoniae Stevens & Young	T	Dead leaves	BR	**Ind**:Mg	193
Scopulariopsis bumptii Salv.-Duval	D	Sediment		**Pac**:O	103
Scopulariopsis silvatica (Oudem.) Apinia as *Spicaria silvatica* Oudem.	D	Sediment		**Pac**:H	156
Scytalidium terminale G.V. Rao & de Hoog	I	Dead leaves	RM	**Atl**:Brz	11
Septoria thespesiae T.S. Ramakr. & Ramakr.	T		TP	"India"	193
Sphaceloma terminaliae Bitanc.	T		TC	**Atl**:Brz	193
Sphaeronaema avicenniae Gonz., Frag. & Cif.	T	Leaves	AG	**Atl**:DR	124,193
Sporotrichum pruinosum J.C. Gilman & E.V. Abbot	D	Sediment		**Pac**:H	156
Stachybotrys chartarum (Ehrenb.) S. Hughes	DI	Sediment Dead wood	AI	**Atl**:EM **Pac**:HK	40,200
Stachybotrys cylindrospora C.N. Jensen	T	Living leaves		**Pac**:M	153
Stachybotrys mangiferae P.C. Misra & S. K. Srivast	I	Dead wood	RS	**Pac**:O	170
Stachylidium bicolor Link	I	Dead wood	AI	**Pac**:HK	200

Stigmina palmivora (Sacc.) S. Hughes as *Exosporium preisii* Bubák	T	Dead leaves	PR		193
Tetraploa aristata Berk. & Broome	I	Dead wood Dead marsh grass	PA	**Pac**:HK,P	8,191,192
Thermophymatospora fibuligera Udagawa, Awao & Abdullah	D	Sediment		**Pac**:O	103
Trichocladium achrasporum (Meyers & R.T. Moore) M. Dixon as *Culcitalna achraspora* Meyers & R.T. Moore	IS	Dead wood Fern rachis Seedlings	AG,AI,AM,AM*, AN,AO,AS,BG,Bn, BP*,CT,KC,RA,RM, RR,RS,RU,SA,Wb	**Atl**:Brz,Bz,EM,F,Lb,Tr,Tx,WSA **Ind**:AI,AP,ESA,Jv,LI,Md,MI,Mr,NI, SL,Sy,TN **Pac**:Br,Fi,G,HK,J,M,O,P,Q,Sh,V	5,6,8,9,12,13,19,25-27,34,41, 45,47,51,53,55-57,91,105, 114-116,118,122,124,126, 128,133,139,145,167,170, 178,194,199,200,201,206, 209,219,221,227,230-235,246
Trichocladium alopallonellum (Meyers & R.T. Moore) Kohlm. & Volkm.-Kohlm. as *Humicola alopallonella* Meyers & R.T. Moore	IS	Dead wood	AA*,AG,AL*,AM*, BP*,CE,Cq,CT,LR, NF,PF,Px,RA,RM,RU,SA,Wb	**Atl**:Ba,Bd,Brz,Bz,Cm,EM,Gh,IC,Lb, SC,Tx **Ind**:AI,AP,ESA,Jv,LI,Md,MI,NI,SJ, SL,Su,Sy,TN **Mid**:K,Y **Pac**:Br,H,HK,J,M,Ms,P,Q,Si,So,T,V, WM	5,6,8,9,19,25-27,39,45-47,50-52,55,57,68,79,83,84,91,105, 106,114,118,122,124,125, 129,134,138,139,141,142, 145,167,199,201,206,209, 214,216,220,221,227,228,231-236,241,246
Trichocladium constrictum I. Schmidt	I	Dead wood		**Ind**:ESA,SL	118,206
Tricladium linderi J.L. Crane & Shearer	I	Dead wood		**Pac**:P	8
Trichocladium nypae K.D. Hyde & Goh	I	Palm petiole	NF	**Pac**:Br:	79,87
Trichocladium opacum (Corda) S. Hughes	IS	Fern rachis Dead wood	AM,AS,RA	**Ind**:Su,TN **Pac**:Br,M	9,46,47,50,53,55,56,195
Trichoderma aureoviride Rifai	D	Roots Sediment	BG	**Pac**:O	103,104
Trichoderma glaucum E.V. Abbot	D	Sediment		**Pac**:H	156,157
Trichoderma harzianum Rifai	D	Roots Sediment	AM,BG,KC,Lu,RS, SA	**Pac**:O	103,104
Trichoderma koningii Oudem.	DI	Sediment Dead leaves	Ax	**Ind**:BI,GI **Pac**:O	10,103,104,198

Trichoderma longibrachiatum Rifai	I	Dead leaves	RM	**Atl**:Brz	11
Trichoderma pseudokoningii Rifai	D	Sediment		**Pac**:O	103,104
Trichoderma reesei E.G. Simmons	I	Dead leaves	AM,BG	**Ind**:ESA	204
Trichoderma viride Pers. as *Trichoderma lignorum* (Tode) Harz	DI S T	Dead leaves Sediment Live roots Seedlings Living leaves	AG,RM,RM,SA	**Atl**:EM,F,Tx **Ind**:WBI **Pac**:H,M,WM	40,120,153,156,157,177,178, 198,244
Ulocladium botrytis Preuss	T	Dead leaves	AG	**Atl**:Tx	120
Urohendersonia pongamiae Nag Raj & Ponnappa	T	Dead leaves	PP	"India"	193
Varicosporina ramulosa Meyers & Kohlm.	I	Dead leaves Sea weed Algae	RM,Sr,TT	**Atl**:Bz,EM,F,Mq,Tg,TX **Ind**:Sy **Pac**:Br,Fi,H,J,WM	24,35,39,40,45, 47,126-129, 133,138,139,142,168,174, 221,227,246
Verticillium calophylli (Wiehe) W. Gams as *Haplographium calophylli* Wiehe	T		CI	**Ind**:Mr	193
Verticillium cellulosae Dasz.	D	Sediment		**Pac**:H	156
Verticillium sulphurellum Sacc.	D	Sediment		**Pac**:H	156
Virgaria nigra (Link)Nees	D	Roots	AM	**Pac**:O	103,104
Volutina concentrica Penz. & Sacc.	D	Roots	RS	**Pac**:O	104
Weisneriomyces javanicus Koord.	T	Living leaves		**Pac**:M	153
Xylomyces rhizophorae Kohlm. & Volkm.-Kohlm.	I	Dead wood	RM	**Atl**:Ba,Bz,Mq,SJ,Tg **Pac**:H	149
Zalerion maritimum (Linder) Anastasiou	IS	Dead wood	Wb	**Atl**:F,PR,WSA,TX **Ind**:LI,MI,TN **Mid**:K **Pac**:HK,J,NSW,NZM,P	8,13,19,25,41,44,114,116, 133,150,195,219,221,231-233,242,246
Zalerion varium Cabello, Aramb. & Liggieri	IS	Dead wood Coconuts Seedlings Dead leaves	AM,AO,BG,RA,RM, RU,SA,Wb	**Atl**:Ba,Bz?,F **Ind**:AI,AP,KI,LI,Md,MI,NI,SL,Sy, TN **Pac**:AS,Br,H,HK,J,M,P,PI?,Si,WG, WM	8,13,19,25-27,35,44,45,47,51, 91,114,116,118,126,129,138, 142,174,177,178,180,183, 195,199,201,214,220,221, 231-234,246

Zygosporium masonii S. Hughes	IT	Sea grass Dead leaves Living leaves Fruit Seedlings	BP,CT,RM,SA,TT,XM	**Atl**:F **Pac**:J,M,WM	35,40,152,153,168,174,177,178
Zygosporium mycophilum (Vuill.) Sacc.	T	Fruit Seedling Living leaves	CT	**Pac**:M	152,153
Basidiomycetes					
Calathella mangrovei E.B.G. Jones & Agerer	I	Dead wood	AM*,BP*,KC	**Ind**:Md **Pac**:Br,M	6,9,26,65,108
Crepidotus krieglsteineri Singer	T	Dead wood	RM	**Atl**:F	193
Dacrymyces intermedius L.S. Olive	T	Dead wood	HT	**Pac**:Ta	193
Fomes avicenniae Bacc.	T	Dead wood	AM	**Ind**:Sm	124,193
Ganoderma resinaceum Boud. as *Ganoderma pulverulentum* Murrill	T	Dead wood	Hm	**Atl**:Gr	193
Halocyphina villosa Kohlm. & E. Kohlm.	I	Dead wood	AA,AA*,AC,AG, AL*,AM,AO,BC*, BG,BP,BP*,CE,KC, LR,NF,RA,RA*,RM, RS,RU,SA,SG,TG, XG	**Atl**:Bd,Bz,C,F,Gh,Lb,SC,Tg,Tr **Ind**:AI,AP,ESA,LI,Md,MI,Mr,NI, SL,Su,Sy,TN **Pac**:Br,Fi,H,M,Mc,P,Sh,Si,T,V	5,6,8,9,15,19,25-27,38,45-47, 50-52,55-57,65,68,79,83,84, 91,108,114-116,118,119,124-126,129,132,134,138,139, 141,161,185,194,199,201, 206,214,216,217,226-228, 235,236,246
Hapalophragmium derridis Syd. & P. Syd.	T	Living leaves	DT	**Ind**:Kn,Mg	193
Hyphoderma crystallophorum Gilb. & Adask..	T	Dead wood	HT	**Pac**:H	193
Hyphoderma scaevolae Boidin & Gilles	T	Dead wood	ST	**Ind**:R	193
Hyphoderma vulkanense Gilb. & Adask.	T	Dead wood	TC	**Pac**:H	193
Hyphodontia aloha Gilb. & Adask.	T	Dead wood	HT	**Pac**:H	193

Inonotus cremeicinctus Corner	T	Dead wood	Ax		193
Mapea radiata Pat.	T	Fruit	IF	"French Polynesia"	193
Nia vibrissa R.T. Moore & Meyers	IS	Dead wood	AG,AM,LR,RM,Sl	**Atl**:Ba,Brz,Bz,EM,F,Gh,Mq,SC, WSA **Ind**:MI,Sy **Pac**:Br,Fi,H,J,M,P,Q,Si,WM	8,12,14,19,39,41,45,47,51,91, 124,126,127,129,133,138, 141,142,145,159,163,169, 214,215,221,226-228,246
Phellinus gilvus (Schwein.) Pat.	T	Dead wood	RM	**Pac**:H	124,193
Phellinus terminaliae (S. Ito & S. Imai) M.J. Larsen as *Fomes terminaliae* S. Ito & S. Imai	T	Dead wood	TC	**Pac**:J	193
Physalacria maipoensis Inder et Desjar.	I	Dead Wood	AM	**Pac:**HK	252
Polyporus ramosii (Murrill) Sacc. & Trotter	T	Dead wood	CI	**Pac**:P	193
Psathyrella rhizophorae Singer	T	Dead seedlings	RM	**Pac**:H	193
Pycnoporus cinnabarinus (Jacq.)Fr. as *Polyporus cinnabarinus* Jacq.	T	Live roots	RM	**Pac**:H	157
Ravenelia stictica Berk. & Br.	T	Dead leaves	PP	**Ind**:SL	193
Schizophyllum commune (L.) Fr.	T	Dead wood	RM		124
Sebacina minima L.S.Olive	T	Dead wood	HT	**Pac**:Ta	193
Skierka agallocha Racib.	T	Dead leaves	EA	**Ind**:Jv	193
Stypella grilletti (Boud.) P. Roberts as *Sebacina gloeofilum* L.S. Olive	T	Dead wood	HT	**Pac**:Ta	193
Trametes demoulinii G. Castillo	T	Dead wood	TC	**Pac**:PNG	193
Trametes rhizophorae Reichardt	T	Dead wood	RM	**Pac**:PNG	124,193
Tulasnella bifrons Bourdot & Galzin	T		HT		124,193
Tulasnella pacifica L.S. Olive	T	Dead wood	HT	**Pac**:Ta	124,193
Tulasnella violea (Quél.) Bourdont & Glazin	T		HT		124,193
Chytridomycetes					
Blyttiomyces verrucosus Dogma	I	Pollen bait		**Pac**:NZ	224
Phlyctochytrium aestuarii Ulken	I	Pollen bait		**Pac**:NZ	224

Phlyctochytrium mangrovii Ulken	D	Sediment		**Atl**:Brz	222,223
Myxomycetes					
Arcyria cinerea (Bull.) pers.	T		RM	**Pac**:H	124
Arcyria virescens G. Lister	T	Live roots	RM	**Pac**:H	157
Oomycetes					
Halophytophthora bahamensis (Fell & Mater) H.H. Ho & S.C. Jong as *Phytophtora bahamensis* Fell & Master	I	Dead leaves	AG,RM	**Atl**:Ba,Cy,F	36,154,179,182,183
Halophytophthora batemanesis (Gerr.-Corn. & J.A. Simpson) H.H. Ho & S.C. Jong as *Phytophthora batemanesis* Gerr.-Corn. & J.A. Simpson	I	Leaves	BG,RS	**Pac**:J?	154,171
Halophytophthora epistomium (Fell & Master) H.H. Ho & S.C. Jong as *Phytophtora epistomium* Fell & Master	I	Dead leaves	BG,RM,RS	**Atl**:CR,F **Pac**:J	36,154,171
Halophytophthora exoprolifera H.H. Ho, Nakagiri & S.Y. Newell	I	Leaves	BG,RA,RM,RS,RU	**Atl**:Ba **Pac**:O,Si	154,218
Halophytophthora kandelae H.H. Ho, H.S. Chang & S. Y. Hsieh	I	Leaves	AA,AG,BG,KC,RS	**Atl**:F,Si **Pac**:J,Tw	42,154,171,179,218
Halophytophthora masteri Nakagiri & S.Y. Newell	I	Leaves	AG	**Atl**:Ba	154,173
Halophytophthora mycoparasitica (Fell & Master) H.H. Ho & S.C. Jong as *Phytophtora mycoparasitica* Fell & Master	I	Leaves - mycoparasite	BG,RM,RS	**Pac**:M,J	36,154,171
Halophytophthora operculata (Pegg & Alcorn) H.H. Ho & S.C. Jong as *Phytophthora operculata* Pegg & Alcorn	I	Leaves	AA,AM,RA	**Pac**:Q,Si	189,218
Halophytophthora polymorphica (Gerr.-Corn. & J.A. Simpson) H.H. Ho & S.C. Jong	I	Leaves	AM,BG,RS		154
Halophytophthora spinosa (Fell & Master) H.H. Ho & S.C. Jong as *Phytophthora spinosa* Fell & Master	I	Dead leaves	AG,BG,LR,RA,RM, RS,RU	**Atl**:Ba,Bo,C,CR,F,Ha,Tr,Vz **Ind**:Sy **Pac**:H,J,M,Si,Vt	36,154,171,180,182,183,218

Halophytophthora vesicula (Anastasou & Chruchl.) H.H. Ho & S.C. Jong as *Phytophthora vesicula* Anastasou & Chruchl.	I	Leaves Seedlings	AG,AI,AM,BG,CE,KC,LR,RA,RM,RS,RU,SA	**Atl**:Ba,Bo,C,CR,Cy,F, Ha,Jm,Tr,Vz **Ind**:Sy **Pac**:H,HK,J,M,Q,Si,Vt	35-37,154,155,171,178-183, 190,218
Phytophthora nicotianae Breda de Haan	I	Disease of roots	AM	**Pac**:Q	238
Pythiogeton uniforme Minden	S	Seedlings	RM	**Atl**:F	177,178
Pythium grandisporangium Fell & Master	I	Dead leaves	RM	**Atl**:Ba,F	36,179,180,183
Thraustochytrids					
Schizochytrium aggregatum S. Goldst. & Belsky	DI	Dead wood Sediment Dead leaves	SA,LR	**Atl**:Ba **Pac**:M	225,229,244
Schizochytrium mangrovei Raghuk.	I	Dead leaves	AO,RU	**Ind**:GI	196
Thraustochytrium aggregatum E.Scholtz	DI	Dead wood Sediment	LR	**Atl**:Ba **Pac**:M	225,229
Thraustochytrium aureum S. Goldst.	D	Sediment		**Pac**:M	225
Thraustochytrium kinnei A. Gaertner	DI	Sedment		**Pac**:M,NZ	224,225
Thraustochytrium multirudimentale S. Goldst.	I	Pollen bait		**Pac**:NZ	224
Thraustochytrium pachydermum E. Scholtz	D	Sediment		**Pac**:M	225
Thraustochytrium striatum J. Schneider	I	Pollen bait Dead leaves	SA	**Pac**:M,NZ	224,244
Ulkenia visurgensis (Ulken) A. Gaertn.	D	Sediment Dead leaves	SA	**Pac**:M,NZ	224,225,244
Zygomyetes					
Absidia glauca Hagem	T	Dead leaves		**Pac**:M	153
Absidia ramosa (Lindt) Lendn.	D	Sediment		**Ind** WBI	198
Absidia spinosa Lendh.	D	Sediment		**Pac**:H	157

Choanephora curcurbitarum (Berk. & Ravenel) Thaxt.	T	Dead Leaves		**Pac**:M	153
Circinella simplex Tiegh.	D	Sediment		**Pac**:H	156,157
Cunninghamella elegans Lendn.	D	Sediment		**Pac**:H	157
Mortierella minutissima Tiegh.	T	Live leaves		**Pac**:M	153
Mucor hiemalis Wehmer	D	Sediment		**Pac**:O	103
Mucor janssenii Lendn.	D	Sediment		**Ind**:WBI	198
Rhizomucor pusillus (Lindt) Schipper	D	Sediment		**Pac**:O	103
Rhizopus stolonifer (Ehrenb.) Vuill. as *Rhizoporus nigricans* Ehrenb.	D S T	Live leaves Sediment Seedlings	RM	**Atl**:F **Ind**:WBI **Pac**:M	153,177,178,198
Syncephalastrum racemosum Cohn	D T	Sediment Live leaves		**Ind**:WBI **Pac**:M	153,198

ABBREVIATIONS USED IN APPENDIX 1

Habitat

D=In sediment, **E**=Endophyte, **I**=Intertidal, **S**=Submerged, **T**=Terrestrial

Host Species

? = uncertainty expressed by author, ***** = pole or block of wood, **AA** = *Avicennia alba*, **AC**=*Aegiceras corniculatum*, **Ad**=*Arthrocnemum indicum*, **AE**=*Avicennia eucalyptifolia*, **Af**=*Avicennia africana*, **AI**=*Acanthus ilicifolius*, **AG**=*Avicennia germinans*, **AL**=*Avicennia lanata*, **AM**=*Avicennia marina*, **AN**=*Avicennia nitida*, **AO**=*Avicennia officinalis*, **AR**=*Avicennia rumphiana*, **Ax**=*Avicennia* sp., **AS**=*Acrostichum speciosum*, **Ay**=*Allophyllus cobbe*, **BA**=*Barringtonia asiaticae*, **BC**=*Bruguiera cylindrica*, **BG**=*Bruguiera gymnorrhiza*, **BH**=*Bruguiera hainesii*, **BM**=*Batis maritima*, **Bn**=*Bruguiera conjugata*, **BP**=*Bruguiera parviflora*, **BR**= *Barringtonia racemosa*, **Ca**=*Casuarina* sp., **CB**=*Caesalpinia bonduc*, **CC**=*Caesalpinia crista*, **CE**=*Conocarpus erecta*, **CI**= *Calophyllum inophyllum*, **Cq**=*Casuarina equisetifolia*, **CR**=*Canvalia rosea*, **Cs**=*Ceriops* sp., **CT**=*Ceriops tagal*, **DE**=*Dalbergia ecastophylla*, **Ds**=*Derris* sp., **DT**=*Derris trifoliate*, **EA**=*Excoecaria agallocha*, **HT**=*Hibiscus tiliaceus*, **HM**=*Hippomane mancinellae*, **Hs**=*Halosarcia* sp., **IF**= *Inocarpus fagifer*, **KC**=*Kandelia candel*, **LR**=*Languncularia racemosa*, **Ls**=*Livistona* sp., **Lu**= *Lumnitzera racemosa*, **NF**=*Nypa fruticans*, **OO**=*Osbornia ocodonta*, **OT**=*Oncosperma tigillarium*, **PA**=*Phragmites australis*, **Pc**=*Pemphis acidula*, **Pd**=*Pandanus* sp., **PF**=*Pluchea x fosbergii*, **PL**= *Pandanus laevis*, **Po**=*Posidonia australis*,
PP=*Pongamia pinnata*, **PR**=*Phoenix reclinata*, **Ps**=*Pluchea* sp., **Pv**=*Pavonia spicata*, **Px**=*Pithecellobium* sp., **RA**=*Rhizophora apiculata*, **RM**=*Rhizophora mangle*, **RR**=*Rhizophora racemosa*, **RS**=*Rhizophora stylosa*, **RU**=*Rhizophora mucronata*, **Rx**=*Rhizophora* sp., **SA**=*Sonneratia alba*, **SB**=*Salicornia brachiata*, **SC**=*Sonneratia caseolaris*, **SD**=*Sonneratia acida*, **SG**=*Sonneratia griffithii*, **Sl**=*Spartina alterniflora*, **SM**= *Suaeda maritima*, **So**=*Sesuvium portulacastrum*, **SP**=*Sonneratia apetala*, **Sr**=*Sargassum* sp., **Ss**=*Sonneratia* sp., **ST**=*Scaveola taccada*, **SV**= *Salicornia virginica*, **TC**=*Terminalia catappa*, **TG**=*Tamarix gallica*, **TP**=*Thespesia populnea*, **TT**=*Thalassia testudinum*, **Wb**=non-mangrove wood bait, **XG**=*Xylocarpus granatum*, **XM**=*Xylocarpus moluccensis*, **Xs**=*Xylocarpus* sp.

Sites

Atl=Atlantic, **Ind**=Indian Ocean, **Mid**=Middle East, **Pac**=Pacific,

AI=Andaman Islands, **An**=Antigua, **AP**= Andhra Pradesh, India, **AS**=American Samoa, **Ba**=Bahamas, **Bd**=Bermuda, **BI**=Bombay India, **Bl**=Bali, **Bm**=Burma, **Bn**=Borneo, Indonesia, **Bo**=Bonaire, **Br**=Brunei, **Brz**=Brazil, **Bz**=Belize, **C**=Columbia, **Cm**=Cameroon, **CR**=Costa Rica, **Cu**=Cuba, **Cy**=Cayman Islands, **DR**=Dominican Republic, **E**=Egypt, **EM**=East Mexico, **ESA**=East South Africa, **F**=Florida, **FG**=French Guiana, **Fi**=Fiji, **G**=Galapagos, **Gh**=Ghana, **GI**=Goa India, **Gr**=Grenada, **Gu**=Guyana, **H**=Hawaii, **Ha**=Haiti, **HC**=Hainan China, **HK**=Hong Kong, **IC**=Ivory Coast, **J**=Japan, **Jm**=Jamaica, **Jv**=Java, **K**=Kuwait, **Ka**=Karnataka India, **Kb**=Kiribati, **KI**=Kerala India, **Kn**=Kenya, **LA**=Louisiana, **Lb**=Liberia, **LI**=Lakshadweep Islands, **M**=Malaysia, **Mc**=Macau, **Md**=Maldives, **Mg**=Madagascar, **MI**=Maharashtra India, **Mq**=Martinique, **Mr**=Mauritius, **Ms**=Marshall Islands, **Mz**=Mozambique, **NI**=Nicobar Islands, India, **NSW**=New South Wales, **NZ**=New Zealand, **O**=Okinawa, **P**=Philippines, **PG**=Papua New Guinea, **PI**=Palau Islands, **Pn**=Panama, **PR**=Puerto Rico, **Pu**=Peru, **Q**=Queensland, **R**=Reunion, **SA**=South Australia, **SB**=Saudi Arabia, **SC**=Saint Croix, **Sh**=Shenzhen China, **Si**=Singapore, **SJ**=St. John, US Virgin Islands, **SL**=Sri Lanka, **Sm**=Somalia, **Sn**=Surinam, **So**=Society Islands, **Sr**=Sierra Leone, **ST**=Saint Thomas, **Su**=Sumatra, **Sw**=Sulawesi, **Sy**=Seychelles, **T**=Thailand, **Ta**=Tahiti, **TN**=Tamil Nadu, India, **Tg**=Tobago, **Tr**=Trinidad, **Tw**=Taiwan, **Tx**=Texas, **Tz**=Tanzania, **WBI**=West Bengal, India, **WG**=West Guatemala, **WM**=West Mexico, **WSA**= West South Africa, **V**=Victoria, Australia, **Vt**=Vietnam, **Vz**=Venezuela, **Y**=Yemen, **Z**=Zanzibar

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MYCOTAXON

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BOOK REVIEWS AND NOTICES

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GENERAL

Tropical Mycology. Vol. 2. Micromycetes. Edited by Roy Watling, Juliet C. Frankland, A. Martin Ainsworth, Susan Isaac & Claire Robinson. 2002. CABI Publishing, CAB International, Wallingford, Oxon OX10 8DE, UK. Pp. xiv + 203. ISBN 0 85199 543 8. Price £ 40, US $ 75.

The second of two volumes arising from the British Mycological Society symposium held in Liverpool in April 2000; the first dealt with 'macromycetes' and was reviewed in *Mycotaxon* **82**: 476-477 (April-June 2002). This part contains 11 contributions which are wide ranging. Three of these are of particular interest to the systematic mycologist: a key to species of tropical nectrioid fungi (G. J. Samuels *et al.*; pp. 13-31), a reassessment of some tropical sooty moulds (Faull *et al.*; pp. 33-39), and the biogeography and phylogeny of downy mildews and their hosts (Spencer & Dick; pp. 63-81). Other chapters are concerned with lignicolous freshwater 'higher' (sic!) fungi, the diversity of fungi on *Pandanaceae,* invasive tree-crop pathogens, lichens, invertebrate pathogens, human tropical mycoses, and pharmacologically active metabolites. In my comments on the first volume, I questioned the wisdom of having two separate rather slim volumes, and the resultant high price for the tropical libraries that would find these proceedings of the greatest value.

Taxonomy of Nematophagous Fungi. By Tian-Fei Li, Ke-Quin Zhang & Xing-Zhong Liu. 2000. Chinese Scientific and Technological Publication, Beijing. Pp. 313. In Chinese. ISBN 7 5046 2859 X. Price 70 Yuan

This is a companion volume to a treatise on the biology of nematophagous fungi by the same triumvirate (Zhang *et al.* 2001). The taxonomic volume includes keys, descriptions, and generally clear line drawings. Although in Chinese, because references to the original places of publication are in English, and the figure captions use scientific names, the work can be used by and will be of value to those with other linguistic traditions. For example, where else could a key to 30 species of *Harposporium* be found (including species published as recently as 1997)? The list of references cited is also impressive, extending to 13 pages and including titles which appeared in 1998. This is the most comprehensive publication on the systematics of these fascinating fungi I have seen since that of Soprunov (1958), and it deserves to have a wide international circulation.

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[1] Books for consideration for coverage in this column should be mailed to the Book Review Editor (address above) in the first instance. Fax (+34) 91 857 3640; e-mail: davidh@farm.ucm.es or myconova@terra.es.

Soprunov, E.F. (1958) [*Predacious Hyphomycetes and their Application in the Cnotrol of Pathogenic Nematodes.*] Ashabed: Turkmen Academy of Science. [English translation (1966), Jerusalem: Israel Program for Scientific Translations.]

Zhang, K.Q., Liu, X.-Z. & Li, T.-F. (2001) *Biology of Namatophagous Fungi.* Beijing: Chinese Scientific and Technological Press.

ASCOMYCETES

Nordic Macromycetes. Vol. 1. Ascomycetes. Edited by Lise Hansen (†) & Henning Knudsen. 2000. Nordsvamp, Gothersgade 130, DK-1123 Copenhagen K, Denmark. Pp. 309, figs 250. ISBN 87 983961 2 9. Price DKr 300.

Although volume one, this is the third and final volume of the triumvirate completing this ambitious project to appear. Volume two, covering polypores, boletes, agarics, and russuloids was released in 1992, while volume three treating heterobasidiomycetes, aphyllophoroid and gasteroid fungi came out in 1997. As the first volume of the three, this part includes general accounts of fungal nomenclature (T. Ahti), how to collect fungi (L. Ryvarden), how to use the flora, and a particularly valuable overview of the vegetation zones and mycogeography of the region (H. Knudsen & S. Ryman). There is also a glossary preceding a succinct overview of the ascomycetes (T. Læssøe) which suggests there may prove to be around 8000 ascomycete species in the nordic countries (and 12 000 species of all groups). This volume treats about 1000 taxa, of which around 800 are disco- and 200 pyrenomycetes.

The supraordinal classification system used follows that proposed in 1997 by Eriksson & Winka (*not* 'Wenka' as printed in the introduction), while the system of orders and ranks below them is essentially that of the 1998 'Outline of the ascomycetes' with a few later changes. Sixteen authors contributed accounts, all but one (A. J. S. Whalley) being from the region; those who prepared the accounts are identified by the appropriate ordinal, family, or generic name. In order to cover so many species within such a limited number of pages, a condensed approach was essential. After each generic name (without date or place of publication), synonyms and common names (Danish, Finnish, Icelandic, Norwegian, and Swedish) follow, and then a brief description of the genus with pertinent notes (e.g. mentioning untreated species) and references to selected publications. The species are presented through keys, the couplets being expanded where terminal taxa are reached to include additional descriptive features, information on habitat, references to coloured illustrations, indications of which of the treated countries they occur in (with an indication of frequency); not infrequently, allied or poorly understood species are also noted here. Just what to include in such a volume was always going to be a problem, but I was pleasantly surprised to see so many small pyrenomycetes covered (e.g. *Bryonectria, Hypomyces, Polystigma*) yet wondered why *Sarea* had been passed over.

While there are no photographs, the line drawings of diagnostic features (mostly ascospores showing ornamentation details), mainly prepared by H. Dissing, are superb. As they are in a block, those not wishing to struggle with keys will often find flicking through these pages a short-cut to generic identification.

Separate indices to generic names in the five languages are provided, as well as a comprehensive index to scientific names - helpfully arranged by epithet to aid those unsure in which genus a particular species might be found.

This work treats more ascomycetes than any other to have appeared in a single volume in recent years, and as it is in English it deserves to become widely used throughout the Northern Hemisphere. All those involved in this project deserve to be congratulated on seeing it to fruition, and providing a much-needed tool for both amateur and professional mycologists; sadly, Lise Hansen died during its preparation but this will remain a memorial to her determination and skill.

The genus *Lasiosphaeria* and allied taxa. By R. Hilber (†) & O. Hilber. 2002. O. Hilber, Postfach 1342, D-93302 Kelheim, Germany. Pp. ii + 9, figs 7. ISBN3 00 09737 6. Price not indicated.

This booklet sets the framework for a future revision of this lignicolous sordariaceous genus by the authors. Five sections are recognized for the first time: sects *Hirsutae* (type species *L. hirsuta*) *Lasiosphaeria* (type species *L. hirsuta*), *Setosae* (type species *L. breviseta*), *Strigosae* (type species *L. canescens*), and *Subiculatae* (type species *L. punctata*). The separations are mainly based on the nature of the peridial hairs or setae, structure of the ascomatal wall, ostiole, ascospore shape and septation, and anamorphs (where known). Notes are also included on *Cercophora, Herminia,* and *Ruzenia* gen.nov. In *Cercophora* the ascospores develop a swollen upper part not seen in *Lasiosphaeria* and the species are coprophilous; the authors wonder if this difference in the ascospores and the divergent substrates are sufficient to merit the retention of separate genera. The monotypic *Ruzenia* (type species *L. spermoides*) is distinguished on the basis of a basal stroma connecting the perithecia; these are also smooth. Finally, two families are discussed: *Iodosphaeriaceae* fam. nov. introduced for the genus *Iodosphaeria.* The type species of *Iodosphaeria* has asci with an amyloid apical ring; that genus had previously been referred to the *Amphisphaeriaceae.* However, the authors point out that the ascospores are quite different from those of other taxa in that family, and that the ascal rings are similar to those in the *Lasiosphaeriaceae* except in their reaction with iodine. Interestingly, a second species of *Iodosphaeria* has no visible apical structures in the asci. Finally, the authors point out that Munk pores occur in *Cercophora* and *Lasiosphaeria* as well as in genera of the *Nitschkeaceae*.

The whole is illustrated by fine line drawings by the late Ruzena Hilber. The publication of this booklet prior to the completion of the monograph was effected in order to allow others to comment on the infrageneric system being proposed – an unusual and welcome step. If you work on these fungi, do examine the proposals for the sectional classification in particular and contact Dr Hilber.

LICHEN-FORMING FUNGI

Key to the Genera of Australian Lichens: Apothecial Crusts. By H. T. Lumbsch, P. M. McCarthy & W. M. Malcolm. 2001. Australian Biological Resources Study, G.P.O. Box 787, Canberra ACT 2601, Australia. [Flora of Australia Supplementary Series No. 11.] Pp. vi + 64. ISBN 0 642 56813 8. Price A$ 31, US $ 16.

Although *The Genera of Australian Lichens* (Rogers 1981) is now inevitably dated, as a set of updated generic keys is provided in the *Flora of Australia* (Rogers 1992) one might be excused for wondering why a new set of keys was prepared. On opening this new book, the reasons are very clear. Not only is it superbly illustrated by colour photographs, but also supporting characters and references to pertinent literature are provided where each genus is keyed out. As it will be many years before the *Flora of Australia* covers all these genera, this will provide a most valuable stop-gap. It is also spiral-bound, imaking it a delight to use next to the microscope! Further, as most genera are far from restricted to the continent, this small book deserves to be sought by amateur and professional lichenologists worldwide. I say sought deliberately as by the time I learnt of its existence stocks in Canberra were already exhausted; fortunately I was subsequently able to purchase a second-hand copy; the prices indicated above are thus somewhat academic. For those wondering why only apothecial crusts are treated, it should be noted that a key to pyrenocarpous genera in Australia appears in the third lichen volume of the *Flora* (see *Mycotaxon* **83**: 505-506, 2002). It is to be hoped that the ABRS will consider reprinting this text shortly.

Rogers, R. W. (1981) *The Genera of Australian Lichens (lichenized fungi).* St Lucia: University of Queensland.

Rogers, R. W. (1991) Keys to Australian lichen genera. *Flora of Australia* **54**: 65-94.

A Revision of the Lichen Genus *Paraparmelia* Elix & J. Johnst. By John A. Elix. 2001. J. Cramer in der Gebruder Borntraeger Verlagsbuchhandlung, D-14129 Berlin, Germany. [Bibliotheca Lichenologica No. 80.] Pp. 224, figs 126, tables 5. ISBN 3 443 58059 9. Price € 76.

With so many parmelioid lichens described, revisions of the various segregated genera have become more and more essential. *Paraparmelia* was introduced in 1986 for species with a grey upper surface, narrow lobes with no marginal cilia, and atranorin in the upper cortex. The species are primarily saxicolous, but some can be rarely terricolous. They can be viewed as usnic-acid deficient *Xanthoparmelia*'s with which they share the same cell-wall polysaccharides and conidial types, and this close relationship is supported by mtDNA sequence data. However, regardless of the issue of generic concepts, such carefully worked revisions are essential to an understanding of the species. Eighty-three species are accepted, a massive increase over the 35 included when the genus name was introduced; nine of the species are described as new here. Most occur in Australia or southern Africa, and none are known from North and South America nor from Europe. I found the introductory sections especially helpful; this includes comparisons with other genera, summaries of species showing particular features, geographical distributions (with species known from particular countries or regions), and detailed information on the secondary compounds. A clear key is provided, although the emphasis on chemical characters may cause difficulties for those without easy access to thin-layer chromatographic facilities. For the accepted species, full details of places of publication and types are provided, and there are also entries for chemistry, previously published illustrations, distribution and habitat, and notes. Lists of specimens studied, distribution maps, and first-rate half-tone photographs are also provided. Twelve species are excluded from the genus, most being transferred to *Canoparmelia* because of differences in the cell-wall polysaccharides; others are referred to *Karoowia* or *Xanthoparmelia.* This carefully executed revision will be needed by all students of Southern Hemisphere macrolichens.

The Lichen Genera *Rinodina* and *Rinodinella* (lichenized ascomycetes, *Physciaceae*) in the Iberian Peninsula. By Mireia Giralt. 2001. J. Cramer in der Gebruder Borntraeger Verlagsbuchhandlung, D-14129 Berlin, Germany. [Bibliotheca Lichenologica No. 79.] Pp. 160, plates 18. ISBN 3 443 58058 0. Price € 80.

Mireia Giralt has been studying the *Rinodina* species in the Iberian Peninsula for over ten years, and has published some 13 papers on the genus to date. This new book represents a synthesis of her knowledge, and brings data on species growing on rock, trees, mosses, and lichens together. Seventy-six species of *Rinodina* and two of *Rinodinella* are accepted, along with "*Buellia*" *parvula* of uncertain generic position. The Iberian Peninsula is thus amongst the richest region for these lichens so far discovered. Information is also presented on 11 excluded species, mostly based on past misdeterminations. The species are keyed out by habitat, something which always worries me as it means that if a species turns up on a different substrate it may not be correctly identified. For each species, full bibliographic citations and types are provided, but not basionyms and synonyms unless used in recent years; full synonymies would perhaps have made the work more comprehensive but at the same time would have increased the length substantially. Details of where further information can be sought is, however, provided, as are descriptions, notes on chemistry, observations and lists of specimens examined. Ascospore sketches are collected together in the final series of plates, but no habitat photographs or micrographs are provided; again, both would have been helpful, especially to show variation in ascospores as they mature, but this would have involved considerably more work. That the work is in English will greatly extend its audience and use around the Mediterranean, but I hope that this will not limit its use in the Iberian Peninsula itself. This is another example of the high level of understanding lichenology in Spain has reached, and the author is to be thanked for synthesizing her studies and making them more readily accessible.

Lichenological Contributions in Honour of Jack Elix. Edited by P. M. McCarthy, G. Kantvilas & S. H. J. J. Louwhoff. 2001. J. Cramer in der Gebruder Borntraeger Verlagsbuchhandlung, D-14129 Berlin, Germany. [Bibliotheca Lichenologica No. 78.] Pp. 444. ISBN 3 443 58057 2. Price € 87.

Jack Elix has become internationally recognized not only as one of our leading lichen chemists, but also a systematist with a wide range of interests who has made – and is continuing to make - a major contribution to Southern Hemisphere lichenology. His publications list from 1969-2000 includes 387 titles; many co-authored and testifying to Jack's willingness to help others. His wide range of interests and popularity are reflected in this volume which has been compiled to mark his sixtieth birthday. That this volume comprises 30 articles involving 54 contributors testifies to his popularity and the esteem in which he has held. However, the authors must have had strict limits placed on the lengths of contributions to attain an average length of 14 pages. This inevitably means that while sound scientifically, few of the papers could be substantial and are often restricted to descriptions of one or a few new species or revisions of small genera. The more substantial contributions concern the families *Candelariaceae* (here subsumed into *Lecanoraceae*), *Fuscideaceae* and *Pannariaceae,* and the genera *Caloplaca, Lethariella, Menegazzia, Miriquidica, Physcia, Placopsis, Rimularia, Sagedia, Tuckermannopsis,* and *Umbilicaria.* Those interested in these groups certainly need to see this volume, and as it has a strong Southern Hemisphere (and especially Australasian) focus it will be sought after by lichenologists working in this region.

Corticole und Lignicole Arten der Flechtengattung *Buellia sensu lato* in den Subtropen und Tropen. By Bernhard Marbach. 2000. J. Cramer in der Gebruder Borntraeger Verlagsbuchhandlung, D-14129 Berlin, Germany. [Bibliotheca Lichenologica No. 74.] Pp. 384, figs 163, tables 6. ISBN 3 443 58053 X. Price € 82.

Buellia, in the broadest sense, is one of the most speciose genera of crustose lichen-fungi with over 400 accepted species. In recent years, some genera have been segregated primarily on the basis of differences in the conidia (e.g. *Amandinea*) or ascospores (e.g. *Hafellia*). However, there has been no overall study of the genus attempting to revise generic concepts, although Nordin has since addressed those referred to *Diplotomma.* Here, Marbach examines the tropical and subtropical species on bark and wood. This is the first time many of the taxa have been critically studied since their original desriptions, and while surprises were to be expected, the extent of the proposals for changes at the generic level are staggering. Not only are nine new generic names introduced (*Baculifera, Chrismofulvea, Ciposia, Cratiria, Endohyalina, Fluctua, Hypoflavia, Sculptolumina,* and *Stigmatochroma*), two genera are resurrected (*Gassicurtia* and *Tetramelas*). Naturally, *Amandinea* and *Hafellia* are accepted, but *Buellia s. str.* and *Diplotomna s. str.* species do not occur on bark or wood in the tropics or subtropics. The author presumes that the proposal to conserve *Buellia* with the saxicolous *B. aethalea* made in 1999 will be accepted. Marbach's new generic concepts are based on a wide range of characters, tabulated on pp. 42-44; these include thallus chemistry, ascospore structure, conidium-type, hymenium inspersion, paraphyses types, apothecial pruinosity, and exciple structure and pigmentation. Not all mycologists would regard all the differences documented here as appropriate to segregate genera, and it is inevitable that much debate will now ensue, some authors accepting particular decisions but not all. It is unfortunate that the study did not include any molecular data as in the early twenty–first century that is increasingly a prerequisite for the justification of major changes in generic concepts. Further, it will be of interest to see how the generic concepts hold when applied to temperate and boreal taxa; this is a refreshing situation to be worked with as it is more usual to struggle to'fit' tropical taxa into concepts based on temperate taxa.

Independently from the issue of generic concepts, Marbach has made an amazing contribution to improving species concepts and unravelling species names from the past. Thirty-one species new to science are described, and numerous species are relegated to synonymy for the first time. For each species, detailed descriptions are provided, and in many cases line drawings of the key microscopical features and distribution maps are included. There are a few photomicrographs and scanning electron micrographs in the introductory sections, but no habit illustrations at all. Keys are provided in both German and Esperanto (a practice of doubtful value), and short diagnoses in the latter language are also to be found. There are notes on pertinent generic names, and also excluded species (some with descriptions and drawings).

This is without doubt a landmark publication which cannot be ignored by any workers on buellioid lichens, who must now take a position on which segregates to accept and which to ignore - while awaiting molecular data.

Taxonomy and Phylogeny of *Buellia* Species with Pluriseptate spores (*Lecanorales*, *Ascomycotina*). By Anders Nordin. 2000. Uppsala University Library, Box 510, SE-751 20 Uppsala, Sweden. [Symbolae Botanicae Upsalienses Vol. 33(1).] Pp. 117. ISBN 91 554 4915 8. Price not indicated.

***Buellia* Species with Plurispetate Spores and the *Physciaceae* (*Lecanorales, Ascomycotina*).** By Anders Nordin. 2001. Uppsala University Library, Box 510, SE-751 20 Uppsala, Sweden. [Comprehensive Summaries of Uppsala Dissertations from the Faculty of Science and Technology No. 593.] Pp. 15. ISBN 91 554 4879 8. Price Skr 50.

The species of *Buellia s. lat.* with multiseptate ascospores have long been in need of a fresh revision. Anders Nordin started to publish on the group in 1995, and this PhD work is the culmination of his studies. The dissertation summary covers six papers, of which the 2000 one cited above is the most substantial. In that, thirty-five species are treated, for which there is a key, detailed descriptions including ultrastructure and developmental information on ascospores, chemistry, distribution maps, and lists of specimens examined. The work has been carefully carried out and this will be the corner-stone for identifications of these taxa throughout the world for many years to come. Five species are described as new to science, several new lectoptypifications are made, and the well-known name *B. epipolia* is treated as a synonym of *B. alboatra*; most collections named as *B. epipolia* are considered to belong to *B. venusta.* In selecting the taxon names to investigate, the author was guided by those that have been formally placed in *Diplotomma,* with the result that some names that might have been expected to be found are missing (e.g. *Buellia rivas-martinezii*). However, the issue of generic circumscription is skirted over, especially the application of the generic name *Diplotomma* to a subset of these species. Nordin does note that that generic name 'might be used in a more narrow sense' but does not take the descision to use it (as some authors have for over 20 years). This might have been wise in view of his absence of molecular sequence data and the current debate as to how *Buellia s. str.* should be typified. A cladistic analysis has the core of this group as a monophyletic clade, but nested within (and between) clades which include species competing as conserved types of *Buellia.* However, as yet unpublished molecular work does show that *Diplotomma s. str.* is a monophyletic taxon separate from other *Buellia* species. Nevertheless, it is pleasing to see such traditional and careful work combined with ultrastructural studies still being recognized as meriting a PhD in the early twenty-first century even without a molecular angle; it is to hoped that this practice will be continued in other universities as without such studies the foundation for molecular investigations will be unsafe.

BASIDIOMYCETES

The *Amanita caesarea* complex. By Gastón Guzmán and Florencia Ramírez-Guillén. 2001. J. Cramer in der Gebruder Borntraeger Verlagsbuchhandlung, D-14129 Berlin, Germany. [Bibliotheca Mycologica No. 187.] Pp. 66, figs 107 (16 in colour), tables 2. ISBN 3 443 59089 6. Price € 46.

This complex includes some of the most attractive and well-known *Amanita* species but has not been subject to a modern reappraisal. Their familiarity is evidenced by them having over 60 common names in Mexico and Guatemala where they are as sought-after as a most desirable food just as are the European members of the complex. The revision is based on a study of over 240 collections from Central and North America, Africa, Asia and Europe. The *A. caesarea* complex is found to comprise at least 13 species, of which four are newly described (*A. basii, A. tectomate, A. tullossii,* and *A. yema* spp.nov.). In addition, eight species in the *A. hemibapha* complex are treated, including one new species (*A. laurae* sp.nov.). Traditional macro- and micromorphological features are used in the separations, and clear line drawings and colour photographs are provided. Six species occur in Mexico, and these are keyed out with notes on some extra-Mexican species. Neither *A. caesarea* nor *A. hemibapha* occur in North America, although *A. caesarea* s. str. is present but rare in Mexico. *A. basii,* with smaller basidiospores, is also present in Spain, while *A. jacksonii* appears to be the commonest species in North America and Mexico. This will certainly remain the basic reference work on this group of fungi for many years and merits a place in the libraries of all specialist agaricologists.

[Polypores of Finland and adjacent Russia.] By Tuomo Niemelä. 2001. Botanical Museum, Finnish Museum of Natural History, P.O. Box 7, FIN-00014 Helsinki, Finland. [Norrlinia Vol. 8.] Pp. 120, figs 69. In Russian. ISBN 952 10 0107 0. Price not indicated.

This survey of the polypores in Finland and adjacent parts of Russia, particularly the Karelian Republic, treats 220 species. Basic information on fruit body types and terminology precedes a series of keys. Drawings of the fruit bodies of selected species are provided, and there is an extensive series of half-tone photographs – the latter poor relations to the colour photographs available in the CD-treatment of the Finnish species (Niemelä & Meike, 1999). Descriptions are provided, but, refreshingly, neither author citations nor details of places of publication are given in the text – features hardly pertinent in a work designed also to appeal to Russian-speaking non-specialists (a fuller treatment in Finnish is also available; Niemelä, 2001); author citations can, however, be found in the index for those requiring them.

Niemelä, T. (2001) Suomen kääpien määritysopas: guide to the polypores of Finland. 13th ed. *Helsingin yliopiston kasvititeen monisteita* **179**: 1-142. [Not seen.]

Niemelä, T. & Meike, J. (1999) *CD-Kääpäopas: CD guide to the polypores of Finland.* Helsinki: Finnish Museum of Natural History.

Flora Fungorum Sinicorum. Vol. 12. *Ustilaginaceae.* Principal editor Guo Lin. 2000. Science Press, Beijing. Pp. xi + 124, figs 266. In Chinese. ISBN 7 03 008228 1. Price 28 Yuan.

This is the sixth volume of which I am aware to have appeared in this ambitious series which endeavours to provide descriptions of all the fungi so far known from the People's Republic of China. This contribution treats 139 genera *Anthracoidea* (16 spp.), *Cintractia* (1), *Dermatosorus* (1), *Farysia* (1), *Franzpetrakia* (2), *Liroa* (1), *Melanopsichium* (1), *Moesziomyces* (1), *Orphanomyces* (1), *Schizonella* (1), *Sorosporium* (1), *Sphacelotheca* (2), *Sporosporium* (35), *Thecaphora* (9), *Tolyposporium* (1), and *Ustilago* (63). In addition, 13 species are excluded for various reasons. For each accepted species, full bibliographic details are provided, as are keys, descriptions and references to published reports and voucher specimens. A particular feature is the plates which include both light microscopic and scanning electron micrographs of the spores of almost all species covered. This level of illustration makes the book of particular value to smut workers outside as well as within China, even though it is appropriately written in Chinese. A list of species by host family and genus is provided, as is a comprehensive index to scientific names of both hosts and fungi. As some 253 species of smut fungi are known just from the Carpathian mountains in Europe (Vánky, 1985) we can be certain that many more still await discovery and documentation in so vast a country as China; the existence of this work will surely stimulate that process.

Vánky, K. (1985) Carpathian *Ustilaginales*. *Symbolae Botanicae Upsalienses* **24**(2): 1-309.

CONIDIAL FUNGI

First Contribution to a Monograph of *Septoria* species in India. By J. Muthumary. 1999. Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai 600 025, India. Pp. 117, figs 19, plates 10. ISBN not indicated. Price Rs 250, US $ 40.

This work, although published in 1999, only just came to my attention and is mentioned here as it has not been reviewed in previous issues of *Mycotaxon*. It describes 83 taxa of which type material was examined for 52. Traditional concepts are followed with an emphasis on host as well as morphological features in species separations. An host-based key is provided, and drawings and photographs are included for many species. Full descriptions, synonymy, and details of types studied are presented, together with information on the Indian collections seen. Three new species are described, *Septoria fusiformis* (on *Hydrocotyle asiatica*), *S. kodaikanalensis* (on *Hydrocotyle asiaticae*), and *S. prinsepiae* (on *Prinsepia utilis*). The name *S. laneopsis* "Comb. nov." is mentioned on p. 20, but on p. 65 *P. launaeae* Rao 1962 non Khan & Kamal 1962 appears; a "nomen novum" for the presumably later homonym rather than a new combination was evidently intended, but sadly not printed on the appropriate page. A list of 47 further species recorded from India is given for which no authentic material could be obtained, and 18 additional species are excluded which require redisposition in other genera. The work has clearly been undertaken painstakingly, and whatever reappraisal of species concepts in the genus comes from future molecular phylogenetic studies, such works provide both a stop-gap for those needing to name these fungi and at the same time the basic framework on which the new technologies need to focus.

MISCELLANEOUS

New World Botany: from Columbus to Darwin. By Ronald H. Petersen. 2001. A. R. G. Gantner Verlag K.G., FL 9491 Ruggell. [Distributed by Koeltz Scientifc Books, Herrnwaldstraβe, D-61462 Königstein, Germany.] Pp. xv + 638. ISBN 3 904144 75 8 (hardback), 3 904144 74 X (paperback). Price DM 180 (hardback), 120 (paperback).

'Ron' Peterson is recognized as one of the world's foremost mycologists. We have long known he had an historical bent, but I had not appreciated that this is extended to such an in-depth knowledge of the botanical exploration of American botany. The book describes the European background to exploration, with extensive information on the politics and territories in that continent as well as the key workers and publications in botany. There is much on early scientific societies and entrepreneurs in France, Germany, Italy, Spain, Sweden and the UK in particular. Details of the voyages of the early European explorers are provided, with maps, before the works and travels of those pioneering botany in North, South and Central America and the West Indies are addressed. The whole work is packed with fascinating information of all kinds, not least on the traits and foibles on many of the individuals involved, which is not easily accessible elsewhere in one place. I cannot imagine any botanist or mycologist not finding this a fascinating work to delve into – and a way to discover something of the human side of familiar names such as Curis, Michaux, Nuttall, Rafinesque and St Hilaire. Did you also know that the first record of a fungus from North America is thought to be *Mutinus elegans* reported from Virginia by John Bannister in 1679. Attention should also be drawn to the chapter by chapter listing of "additional readings" which includes many items that would not normally cross a mycologist's desk. In such an information-packed work, it is inevitable that slips arise. Sadly, one reviewer (Jackson 2002) has sought to highlight many of these, although he has missed or does not cite others (e.g. publication of *Species Plantarum* in 1743 mentioned on p. 232, but correctly given on p. 234). Jackson does not seem to have understood the potential value of the work for those wishing to determine just where some of the early collections were made; I wish it had been to hand when I was working on North American alectorioid lichens in the 1970s. Ron is to be thanked for making the amazing amount of information he has amassed over the years available to all. Although as in all good science one should endeavour to verify facts before citing them and this should be borne in mind when using this as a reference source, but in my view this is a work that should be in key botanical and mycological reference libraries worldwide.

Jackson, I. (2002) Tidbits from term papers. *Taxon* **51**: 228-229.

The Poverty of the Linnaean Hierarchy. By Marc Ereshefsky. 2001. Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, UK. Pp. x + 316. ISBN 0 521 78170 1. Price £ 40.

Subtitled ‘A philosophical study of biological taxonomy’, this book by an Associate Professor of Philosophy at the University of Calgary is a fascinating book to dip into, but in small doses if you are a practising taxonomist rather than a philosopher and do not seek a sudden rise in blood pressure. By looking at the names of people acknowledged in the Preface it is obvious that the slant is the cause of those supporting the PhyloCode and this certainly proves to be the case. There are, for example, eight references to papers by de Queiroz but no mention whatsoever of ones relating to the Draft BioCode. There is also a zoological bias, as evidenced by the citation of only the 1988 edition of the International Code of Botanical Nomenclature and not those of 1994 or 2000, and no mention of the approaches of the virologists (and Regenmortal’s insightful approaches). In the final chapter on ‘The future of biological nomenclature’ 11 recommendations are made for use in the post-Linnean system; amongst these are not assigning taxa to Linnean ranks, the retention of suffixes but not indicating a rank, optional use of suffixes, no italicisation of names, retaining binomials and trinomials in use but not interpreting them as having a rank, using uninomials for newly discovered basal taxa, and giving phylogenetic definitions to names. I decided to draw attention to this book here, as I feel it is important for mycologists to appreciate the kind of thinking that is appearing in some esoteric circles. However, I would have preferred to see a more balanced approach to the topic rooted in the main purpose of taxonomy, to provide a stable and unambiguous method of communicating about organisms.

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Page 32, line 21	for	*cymbbopogoni-distanti*	read	*cymbopogonis-distantis*
Page 81, line 29	for	*triseptata*	read	*triseptatum*
Page 91, line 10	for	*clusia*	read	*clusiae*
Page 143, line 7	for	*E. nilgirisiensis*	read	*E. nilgirisiense*
	for	*E. indica*	read	*E. indicum*
*Page 143, line 17	for	***Entoloma nilgirisiensis***	read	***Entoloma nilgirisiense***
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Page 227, line 7	for	*Sporochisma*	read	*Sporoschisma*
Page 227, line 12	for	*Sporochisma*	read	*Sporoschisma*
Page 353, line 5	for	*Pseudobotyrtis*	read	*Pseudobotrytis*

*** Both of these new names are to be treated as published correctly by virtue of this notice of errata.**

MYCOTAXON

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(updated January 2003)

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This index includes names of genera, infrageneric taxa, species, and infraspecific taxa, as well as new names of suprageneric taxa. All new names are in CAPITALS. The page number on which a new name is proposed is followed by an asterisk (*).

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